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American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

JUNE 21, 1954

Process Evaluation at Fairchild

A SPECIAL REPORT

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Tooling for Precision

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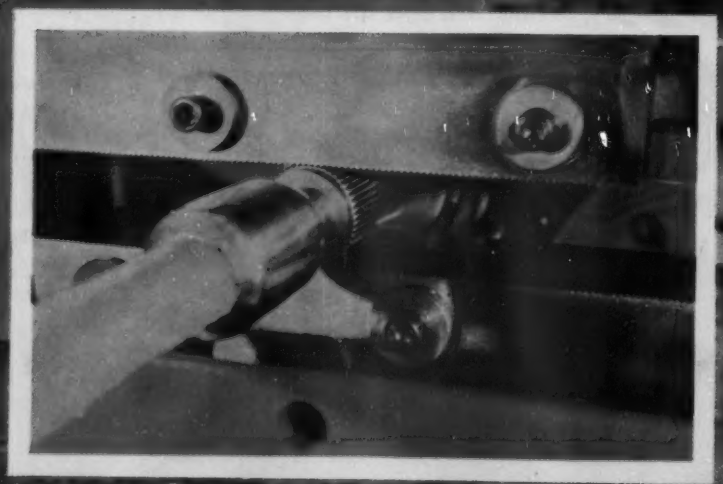
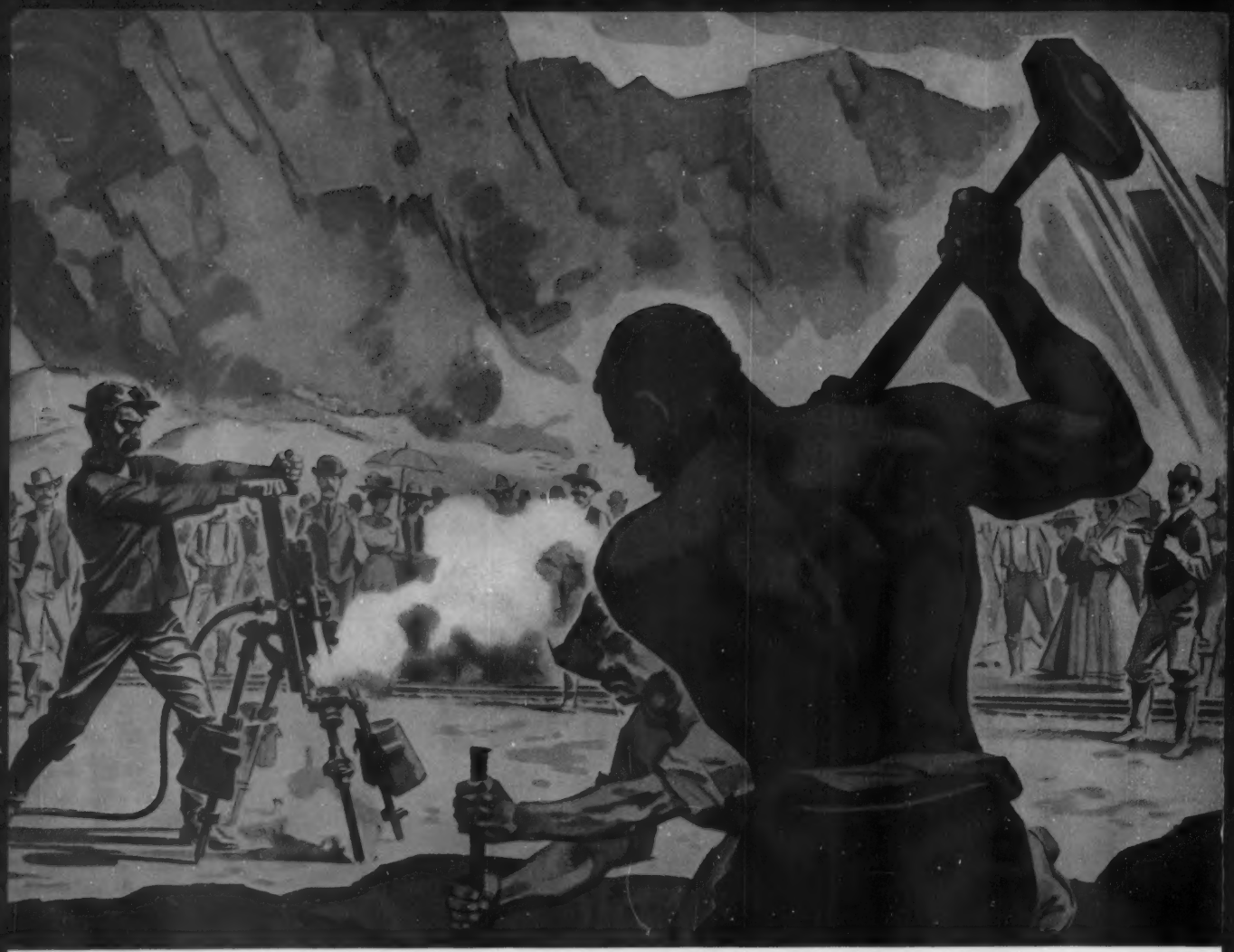
Russians Harness Plastic Mass



Spline rolling — page 2



Machine vs. muscle — a duel to the death!

COMPETITION was *mighty* rough on the great Jawn Henry, famed steel-driving rock driller of the last century. For he pitted his strength against a steam-driven drill and *won*—only to die, hours later, from the strain. And the steam drill (later converted to air) replaced all hand methods of drilling rock.

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MAGAZINE OF METALWORKING PRODUCTON

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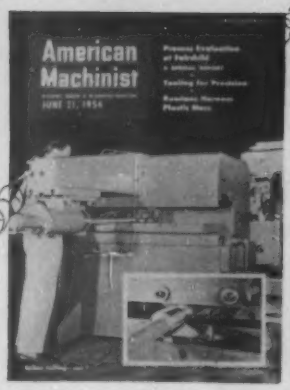

chips

SPLINE ROLLING . . . Combination fine-pitch teeth or serrations are rolled within 0.001-in. variation measured over pins in the new Flo-Form spline roller just announced by Michigan Tool Co, Detroit. A hydraulic cylinder pulls the bottom rack and change gears actuate the top rack in the opposite direction simultaneously, so the process is like that of rolling taffy between the hands. Racks have opposite tapers, so spline teeth reach full depth on the final turn of the shaft. Teeth have a liminated structure with laminae parallel to the tooth dedendum, are rolled in as little as 10 sec, floor to floor. Initial plans are to produce the unit in three sizes. The machine, and a closeup of the process, are shown in color on our cover.

PROCESS EVALUATION . . . At Stratos Div, Fairchild Engine & Airplane Corp, each new part must be approved by the process engineer. Parts already in production are being evaluated, too, for changes in process that can save big money. In an 8-page Special Report, Associate Editor Stocker explains the system, shows an average saving over $5000 per part, indicates why changes were made to casting, stamping, powder metal, and the like.

WORMGEAR HOBBING . . . Two Special Reports are included in this issue, because we got wind of a very special AGMA paper by Ernest Wildhaber we figured you'd want to hear about pronto. It's an 8-page foldout insert taking a new look at wormgear hobbing. It's worth a close look by you.

TITANIUM . . . There's a flood of tooling data on titanium these days. We're trying to pick the significant currents in it, hence bring you two short stories in this issue, one on drilling, one on grinding. . . . Two years of research taught Republic Aviation a new drill design that gives 200 holes per drill, cutting dry in a portable drill, and up to two diameters deep. . . . A further report on Cincinnati Milling work on grinding shows results with special wheel-fluid combinations. E J Krabacher tells the story.

TOOLING . . . Ford Instrument has done some exceptional tooling for induction soldering, projection welding, and for small gears, all to go into some precision instruments. The story-in-pictures is our lead article. . . . Dirck Olton of Behr-Manning gives some tips on contact wheels for abrasive belts, and Laurence Kirk of Lipe-Rollway (see biog) some hints on using air for fixtures and tooling. . . . There are also some quick tips on carbides in our Reference Book Sheets.

PLASTIC MASS . . . The Russians have now harnessed a plastic mass to replace hydraulic oil for transmitting pressure. We show jigs, fixtures, dies and tools in which the plastic mass actuates pistons, punchs, mandrels, that require less-close tolerances.

COMING . . . July 5 *AM* will include a very Special Report of 16 pages on aircraft production, based on a 5-week survey by Andy Ashburn. There'll also be articles on calculating worm-thread profiles, on magnetic chucks, automatic brushing, improved bolt design, and on cutoff tools. The cover will show an extensive hammer line at Douglas Aircraft.

AIR USER . . . Laurence H Kirk, general supt at Lipe-Rollway Corp, Syracuse, came up from his Havre De Grace plant, 38 years ago to spend two weeks working with Lipe officials on a series of patent drawings. He has been with Lipe ever since. He has been largely responsible for Lipe-Rollway's extensive use of pneumatic devices on machine tools to lessen fatigue. Because such a variety of setups is required to manufacture over 30 different clutch sizes and models, air-powered controls, he thinks, are far more efficient than more conventional overhead assembly or roller conveyor lines. He describes them in this issue.

ONE CUT
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These and other FILMATIC advantages add up to higher production and lower cost of precision ground work for your shop. You may obtain the complete FILMATIC story by writing for our new booklet, No. G-604. And if you would like brief information on the entire line of CINCINNATI Grinding Machines, look in Sweet's Machine Tool File or write for our general catalog No. M-1776-1.

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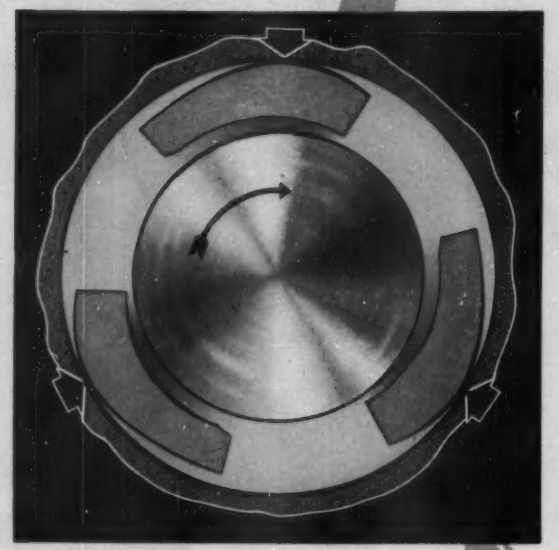
The FILMATIC principle. During rotation, high pressure oil wedges support and automatically centralize the spindle—no adjustment required.



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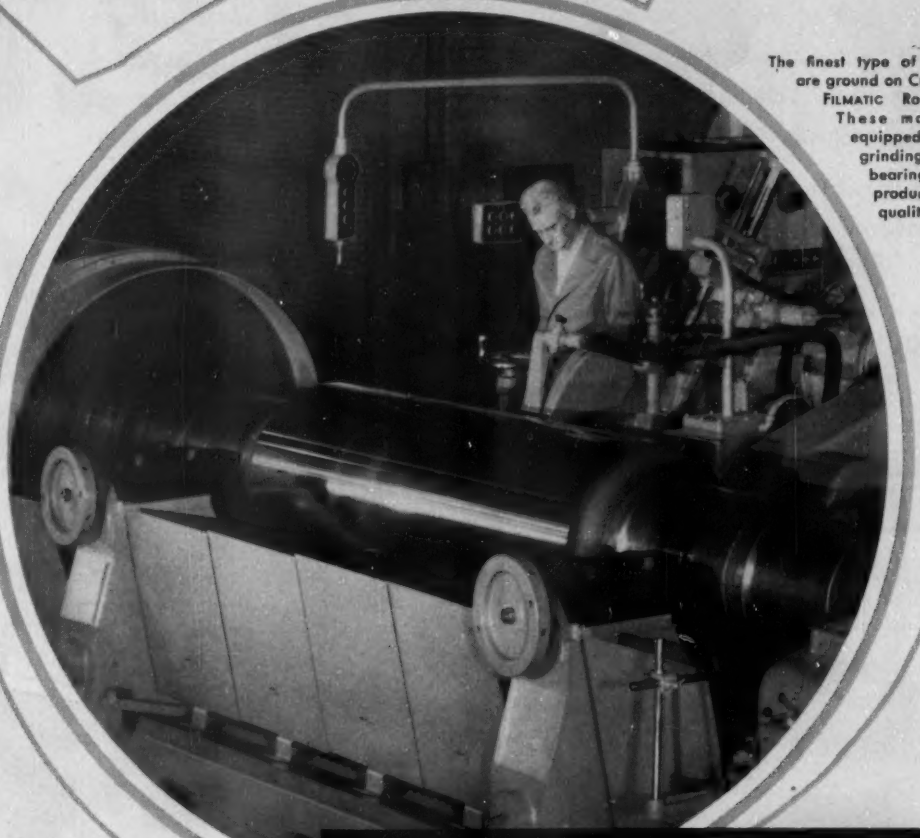

The finest type of rolls are ground on CINCINNATI FILMATIC Roll Grinders. These machines are equipped with FILMATIC grinding wheel spindle bearings, a big factor in producing low-cost, high-quality finishes.

An attractive new book, "The X-Ray Story of Filmatic" is yours for the asking. Publication No. G-604.

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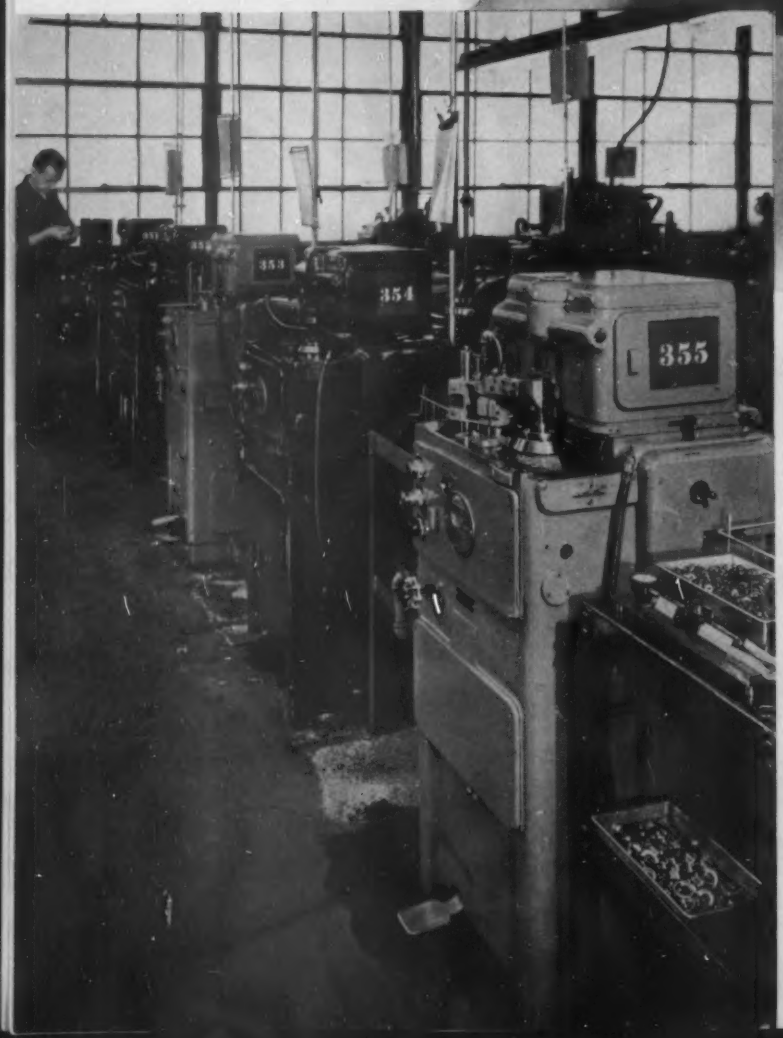


27 TEETH...

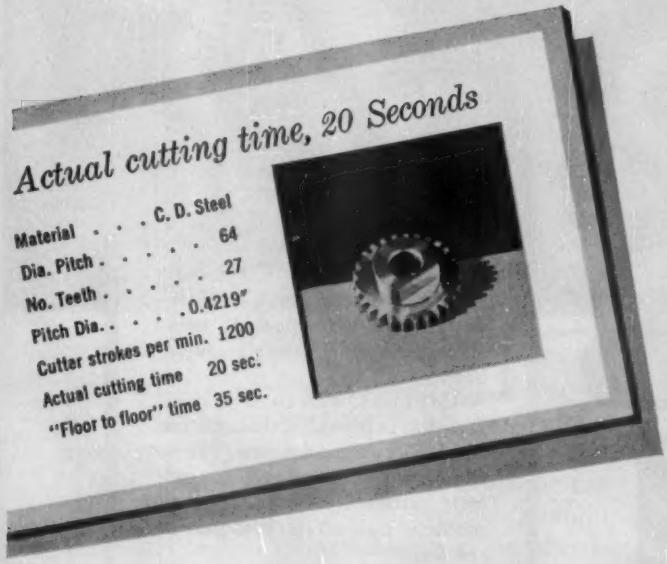
THE *Fellows*

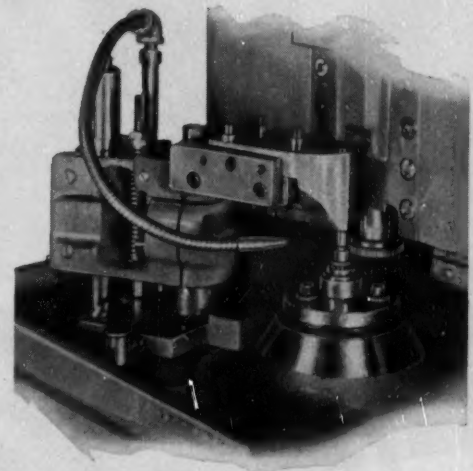
. demands high-speed gear cutting

PRODUCTION schedules at Revere Camera's big Chicago plant are under pressure. 3-D slides and the REVERE STEREO camera are currently in exceptional demand.

So much so that over 30% of the output of their battery of Fellows Fine-Pitch Gear Shapers is at present concentrated on stereo camera parts. Various film feed, focus and shutter parts are turned out. One, in slightly magnified scale, is pictured and detailed below. Cutting is a typical Fellows high-speed operation.

Revere rightly expects top quality performance from its Gear Shapers—and gets it. So will any precision shop which pins its faith to the Fellows Method. Capacities of the several types of Gear Shapers range from 1/16 inch to 120 inches. A Fellows Sales Engineer can give you cost and performance data on the type best suited to your job. Write, wire or phone the nearest office.


Actual cutting time, 20 Seconds
Material . . . C. D. Steel
Dia. Pitch 64
No. Teeth 27
Pitch Dia. . . . . 0.4219"
Cutter strokes per min. 1200
Actual cutting time 20 sec.
"Floor to floor" time 35 sec.



Fellows 3" Fine-Pitch Gear Shaper cutting stop gear for Revere Model 33 Stereo in 35 seconds 'floor to floor'.

GEAR SHAPER COMPANY

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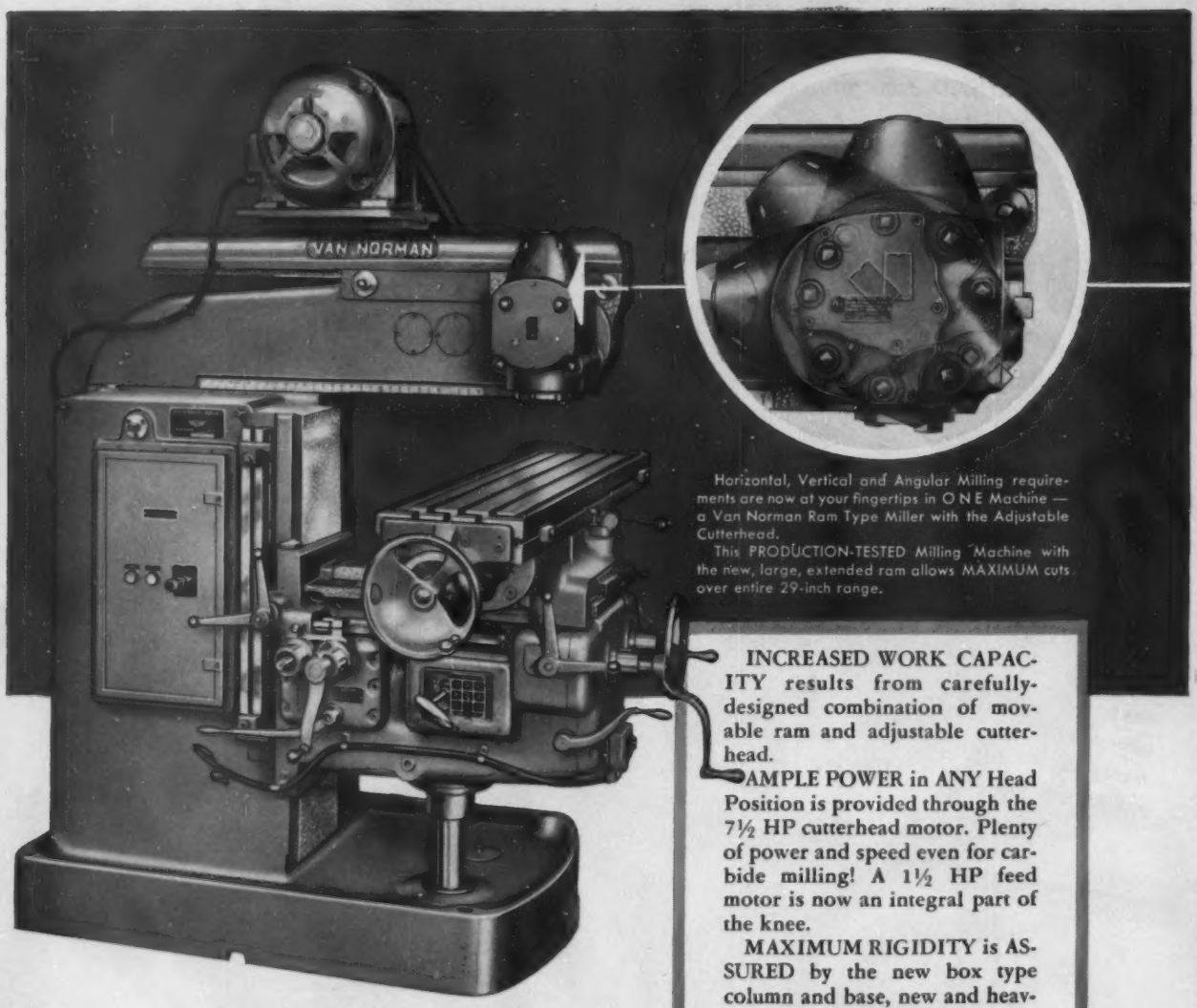

Horizontal, Vertical and Angular Milling requirements are now at your fingertips in ONE Machine — a Van Norman Ram Type Miller with the Adjustable Cutterhead.

This PRODUCTION-TESTED Milling Machine with the new, large, extended ram allows MAXIMUM cuts over entire 29-inch range.

INCREASED WORK CAPACITY results from carefully-designed combination of movable ram and adjustable cutterhead.

AMPLE POWER in ANY Head Position is provided through the 7½ HP cutterhead motor. Plenty of power and speed even for carbide milling! A 1½ HP feed motor is now an integral part of the knee.

MAXIMUM RIGIDITY is ASSURED by the new box type column and base, new and heavier knee, saddle and table assemblies.

VAN NORMAN Manufacturers of — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

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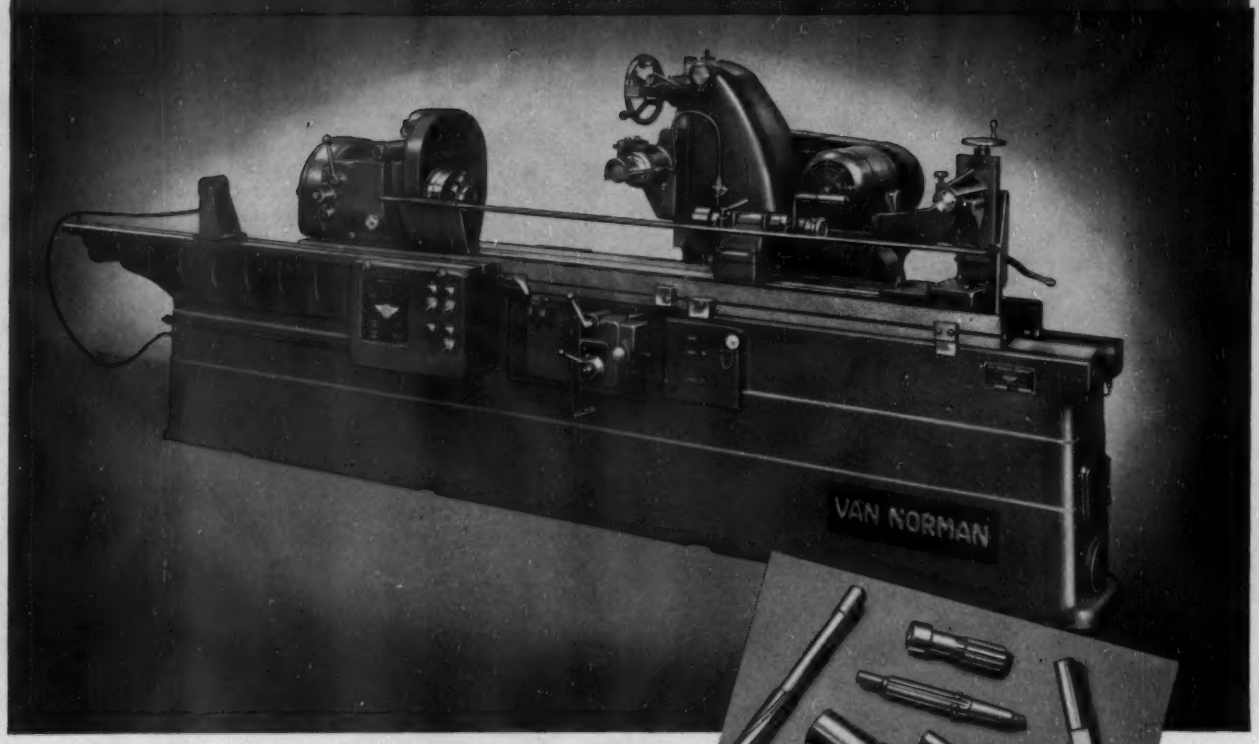
Increase Output



Typical Parts Ground on Van Norman Spline and Gear Grinders

Van Norman Spline and Gear Grinders operate on an automatic closed cycle with formed wheels producing results in finish, accuracy and speed that increase production at reduced costs.

Van Norman machines will also grind internal and external helical or spur gears — straight, taper and helical splines. They may be adapted to shave splines.

Phone, wire or write Van Norman for assistance with your spline and gear grinding problems. Van Norman engineers, specialists in grinding, are immediately available.

VAN NORMAN CO., Springfield 7, Mass., U.S.A.

Improved LANROLL Attachment for Precision Thread Rolling on Automatics

Important improvements for economical thread rolling to Class 4 limits have resulted from changes in the design and construction of the LANROLL Attachment for automatic screw machines.

These improvements, which insure a degree of stabilization between the workpiece and the attachment never previously obtained in a tool of this type, provide:

(1) A well-balanced micro structure of the workpiece through reduced sidewise pressures between the rolls and threads produced.
(2) Low gear-tooth and thrust-bearing loads.
(3) Thread rolling solid to the shoulder with no danger of roll damage.
(4) Longer roll life as rolling wear is distributed equally between the two rolls.
(5) Precision rolling of coarse pitch threads to Class 4 fit without drunkenness.

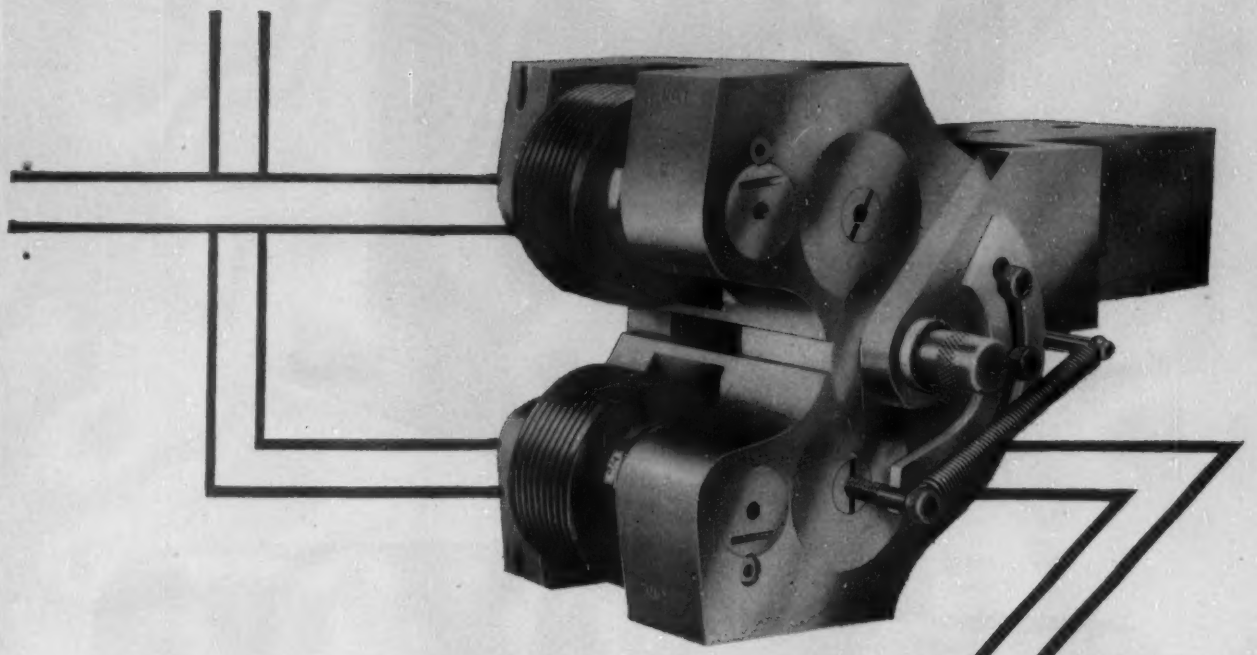
The improved LANROLL Attachment is furnished in two sizes: the #18 Attachment to permit rolling of #5-44 pitch to ½"—13 pitch threads up to $1\frac{3}{16}$" in length; and #20 Attachment for rolling ⅜" —24 pitch to 1"—8 pitch threads up to $1\frac{5}{16}$" in length. A new system of size adjustment assures operation of the Attachment for every size within its range as though it were exclusively engineered for the particular workpiece being threaded.

The improved LANROLL Attachment has other important new features: *Attachment Tipping* to avoid indexing interference, allowing a more rugged construction and the use of larger rolls, resulting in an increased number of starts and longer roll life; *Precise Timing* to avoid experimentation or near-guess timing which may result in damage to the rolls on initial rolling; *Adjustment for Taper*, to eliminate any taper which may occur, that can be made without removing the Attachment from the machine.

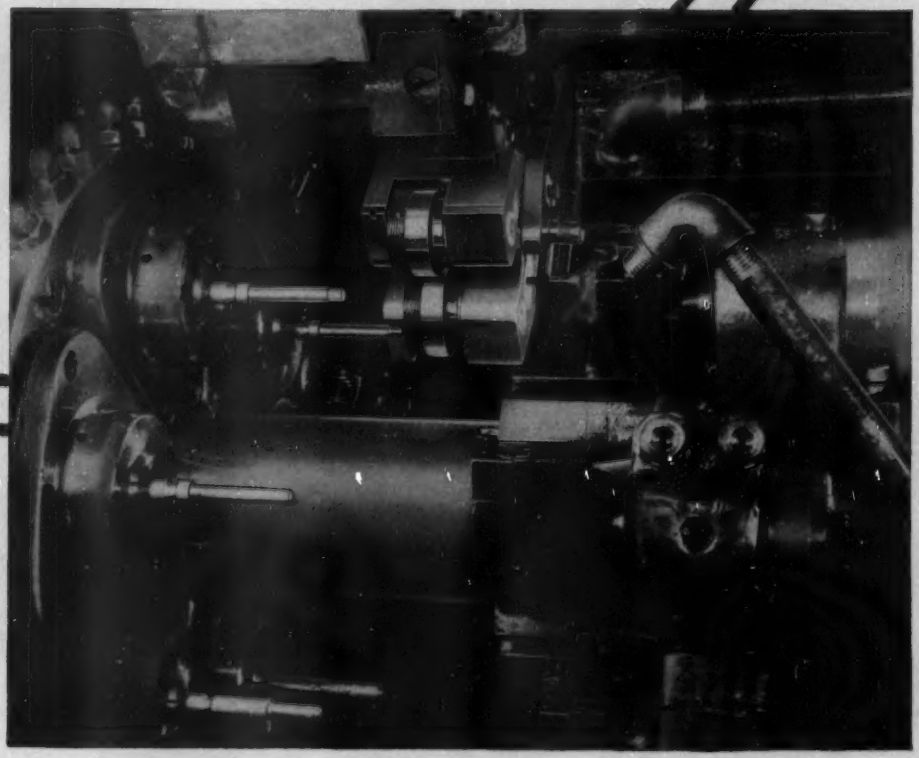
More complete information will be sent on request. Please send specifications when writing.

• LANDIS *Machine* CO.
WAYNESBORO PENNSYLVANIA •

379-C



The new #18 LANROLL Attachment is shown on a 9/16" RA6 Acme-Gridley Automatic at the Mac-it Parts Company in Lancaster, Pa. 1/4" 20-pitch threads 9/32" long are being rolled on stripper bolts of 4140 steel to a Class 4 (Class 3 required) fit within .012" of the shoulder with excellent thread finish.



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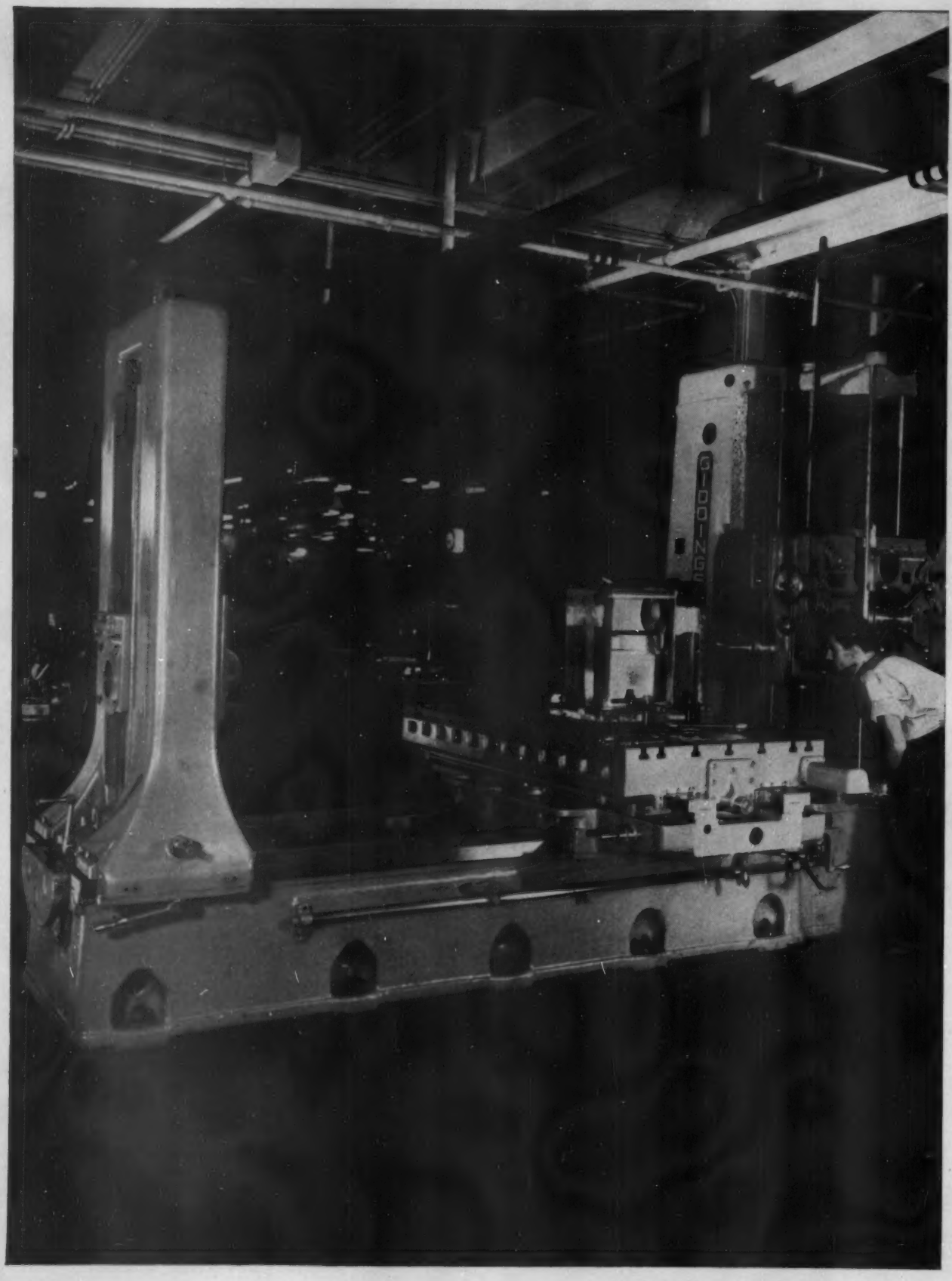
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Compare horizontal boring machines feature by feature, advantage by advantage. Study the quality of their construction, the basic components and accessories or attachments available. You'll soon discover why the table type G&L 340-T is unmatched in its class for capacity, versatility and long-lived precision.

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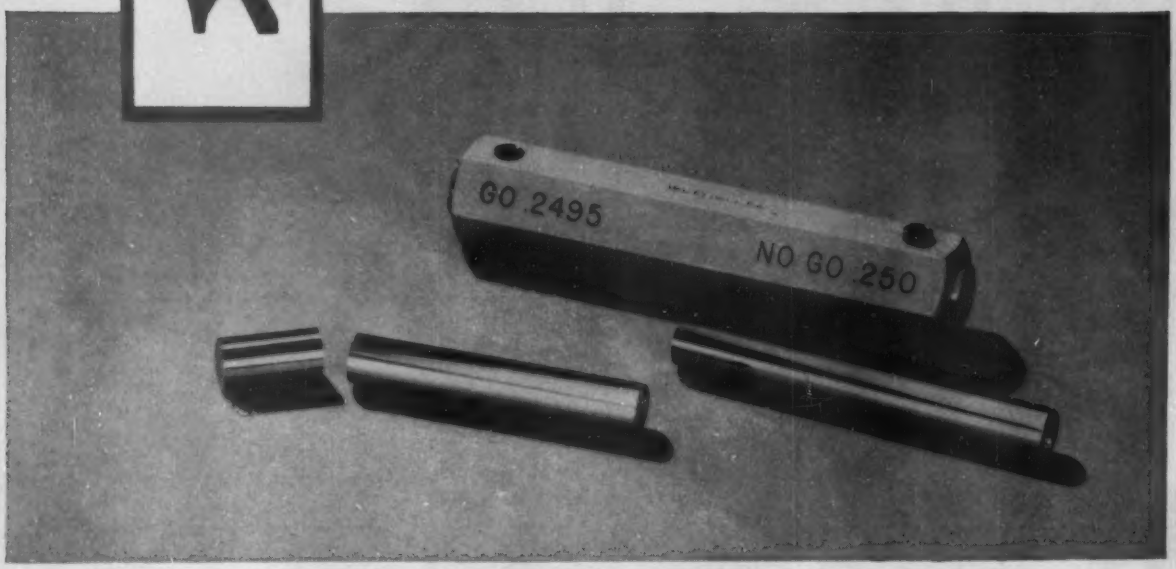

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VK Wire Type Plug Gages are fully described in Catalog & Hand Book No. 35, available on request by writing to: The Van Keuren Co., 173 Waltham St., Watertown, Mass.

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35th YEAR

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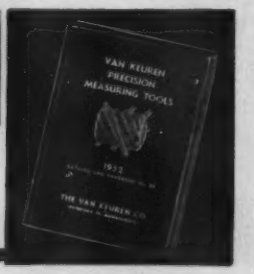
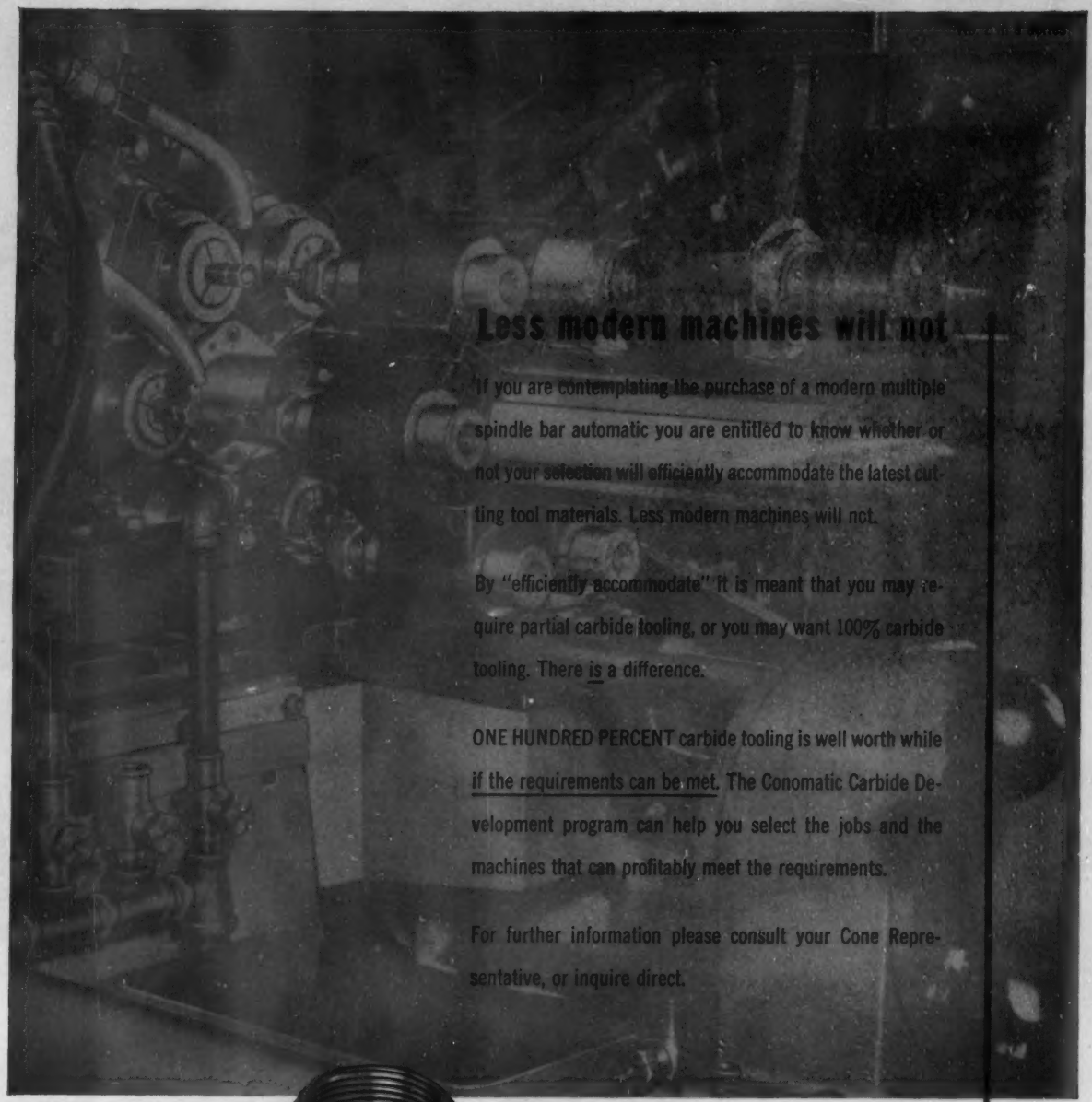




Less modern machines will not

If you are contemplating the purchase of a modern multiple spindle bar automatic you are entitled to know whether or not your selection will efficiently accommodate the latest cutting tool materials. Less modern machines will not.

By "efficiently accommodate" it is meant that you may require partial carbide tooling, or you may want 100% carbide tooling. There is a difference.

ONE HUNDRED PERCENT carbide tooling is well worth while if the requirements can be met. The Conomatic Carbide Development program can help you select the jobs and the machines that can profitably meet the requirements.

For further information please consult your Cone Representative, or inquire direct.

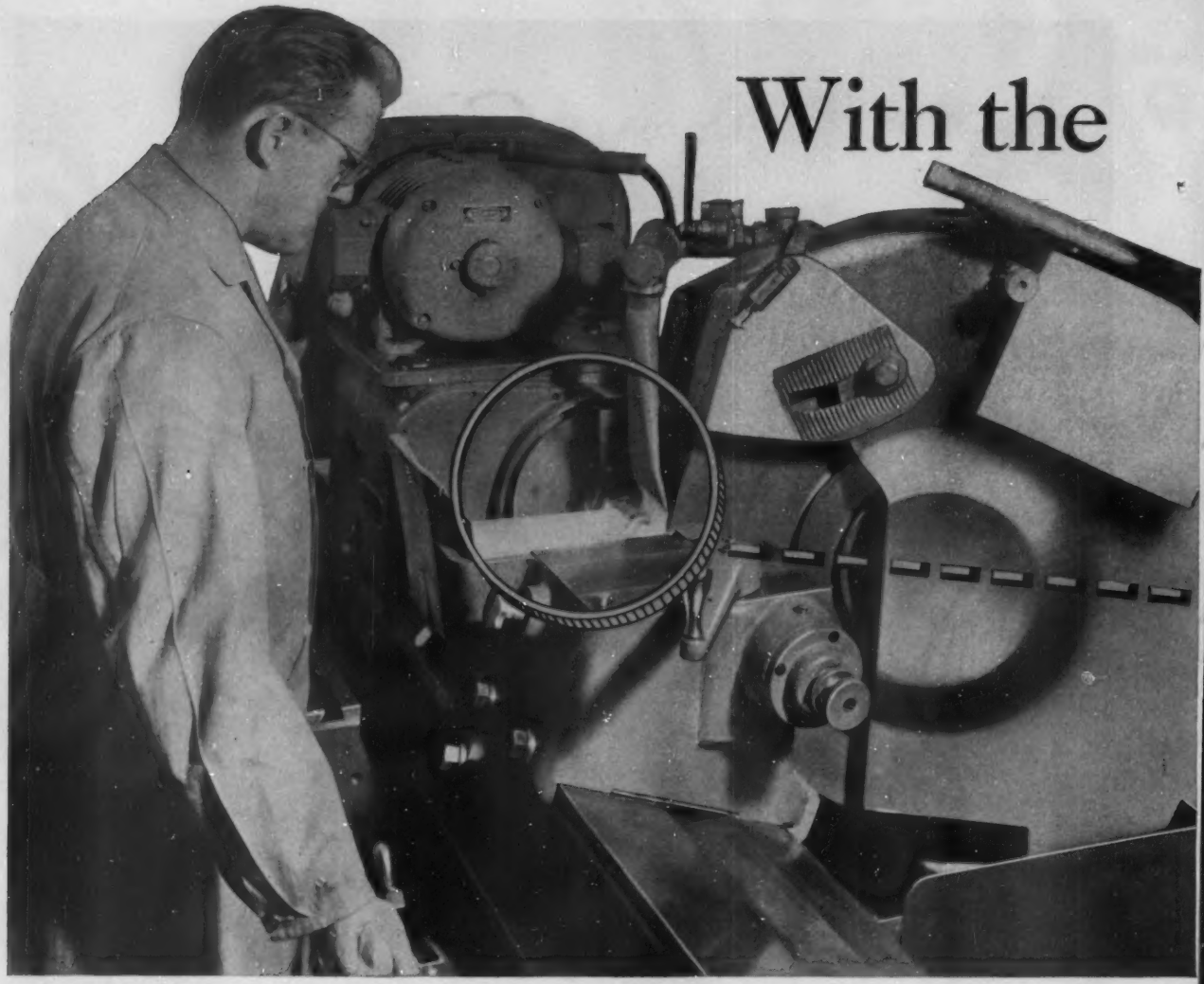
MATERIAL—1040 STEEL

	HSS	CARBIDE
Cycle Time	*	30 secs.
Work Spindle Speed	*	670 R.P.M. at 160 S.F.
Tool Wear	*	2000 pcs. per grind

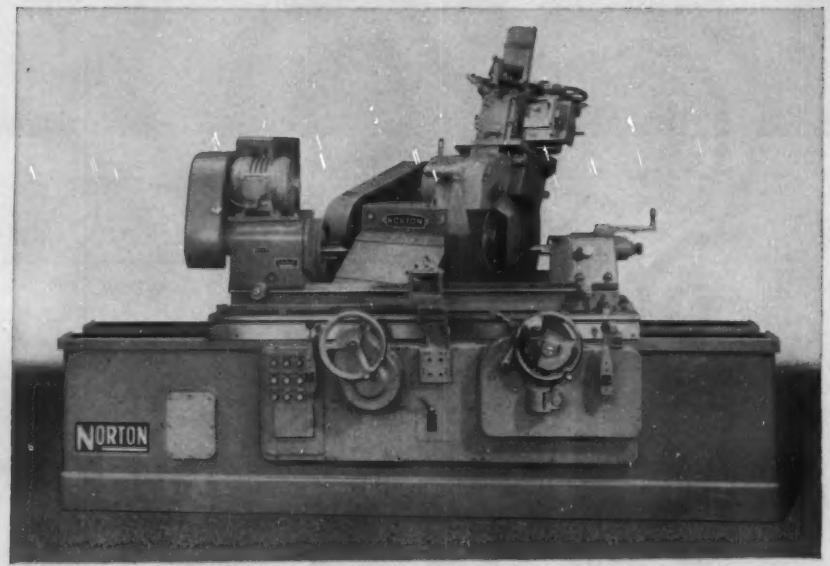
*Hot rolled material prevents fair comparison

Conomatic } CONE AUTOMATIC MACHINE COMPANY, INC. WINDSOR, VT., U.S.A.

With the



Thrust Surface And Adjacent Diameter are both ground at once on the new Norton Type CV-4 semiautomatic wheel-slide grinder. And you get better quality results! Because this machine leaves a concentric grain pattern in the thrust surface finish — assuring a better seal surface and appearance than side wheel grinding can produce.



The Type CV-4 is available with hand table or hydraulic power table drive in swing capacities of 10″ and 14″, and work lengths of 18″, 36″, 48″ or 72″.

Norton Type CV-4 Semiautomatic Angular Wheelslide Grinder

you can do several grinding jobs at once

Now you can grind thrust surfaces and adjacent diameters in one automatic plunge grind operation! The new Norton Type CV-4 semiautomatic angular wheelslide grinding machine eliminates the separate operation on the shoulder or thrust surface that is normally necessary with conventional cylindrical grinders.

This alone means important savings in time and labor costs. And you get plenty of additional benefits from the Type CV-4's rapid grinding action, simplified operation and top-quality production.

Improved grinding wheel feed

The automatic wheel feed includes a "click-count" index, enabling settings for work diameter reduction in increments as fine as .0001" — instantly. Graduated wheel feed hand wheel, located to eliminate reaching, indicates amount of feed as it rotates. Both length and rate of automatic wheel feed easily adjusted from operating position.

Simplified operation

Operator merely loads; starts automatic cycle, and unloads. Fatigue is decreased, helping prevent production lag.

The automatic wheel guard truing device (optional) provides additional operating ease. Push-button control of straight, stepped or formed truing eliminates need of skill and reduces wheel cost per piece ground. In addition, the Type CV-4 can be easily adapted to special jobs with Norton-engineered chucking heads, locating and loading-assist equipment for greater productivity.

Easier, lower cost maintenance

Ramped outlet from coolant tank speeds clean-out . . . pumps and motors all outside and easy to reach . . . electrical controls all grouped in raised enclosure . . . base ways protected by steel tape guards, requiring no additional floor space . . . hydraulic oil and ways lubricant carried in outside reservoirs with large gauge-glasses.

For your own grinding jobs

investigate the many advantages of the new Norton Type CV-4 semiautomatic angular wheelslide grinder. See your Norton Representative or write direct for Catalog. And remember — only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

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GRINDERS and LAPPERS

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NOW! new speed and economy—
added ease and convenience-

APEX MAGNETIC BIT HOLDERS and INSERT BITS

APEX Magnetic Bit Holder
Standard ¼" Hex Drive

Any Apex magnetic bit holder will accommodate a full range of Apex insert bits. All bits are easily and quickly interchanged in the holder, permitting a minimum bit inventory to cover most screwdriving requirements. Insert bits "float" slightly in the holder to provide easier alignment with screw recess and to reduce bit wear. Insert bits may be economically discarded when worn; bit holders last indefinitely.

Available for power, spiral and hand drivers

APEX Magnetic Hand Driver
Standard Length, Superloid Handle

Manufactured under Patent Nos. 2,550,775—2,522,217

Originators and Pioneer Developers of Bit Holders and Insert Bits

Non-Magnetic Bit Holders, Power Bits, Hand Drivers, Offset Drivers, Finder Sleeve Assemblies, Combination Hand Screw Drivers, Service Drive Bit Holders and Bits.

for your production

screwdriving and nut running!

APEX MAGNETIC SOCKETS

Apex MAGNETIC Bit Holders and Sockets place screwdriving and nut running among the simplest and fastest of all production operations. Your tool operators gain a new dexterity that eliminates costly lost time and motion when starting screws and nuts. Apex MAGNETIC operation is at its best in those hard-to-reach spots, even permits working straight down when necessary.

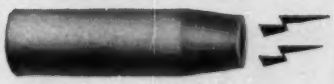
A permanent magnet in bit holders and sockets holds the screw or nut firmly in position. Bit holders have a bit retaining ring to keep the insert bit in place. This patented Apex construction prevents insert bits from pulling out of holder when in operation.

Apex offers the speed, economy, ease and convenience of a complete MAGNETIC operation for every production screwdriving and nut running application. Start *now* to reduce your driving and fastening costs by getting the facts about Apex MAGNETIC screwdriving and nut running.

for Sheet Metal Screws

Available with broached openings from ¼" to 5/16", for driving sheet metal screws, hardened and commercial cap screws.

for Hex Head Nuts



Available with broached openings from ¼" to 5/16", for running hex head nuts, bolts, pal nuts, etc.

Apex Magnetic Sockets, for use with power, spiral and hand drivers, have a permanent magnet which holds the screw or nut firmly in position. Saves time in starting and fastening work in hard-to-reach areas, permits one-hand operation when necessary.

CATALOG 21

The authority on screwdriving and nut running tools, includes complete listing, specifications, prices. 56 illustrated pages. Write, on your company letterhead please, for your copy.

APEX TOOLS

MAGNETIC bit holders, sockets

THE APEX MACHINE & TOOL COMPANY
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YES, you'll find the Warner & Swasey Tool Catalog in plants all over the world—both in the shop and "up front"—ready with the answers when the problem is tooling!
It features the industry's most complete line of tools—over 700 in all—with illustrations, specifications, and "how to" information that will help you make your machines produce more efficiently, *more profitably,* through better tooling!

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KRW
HYDRAULIC PRESSES
go everywhere!

We've seen so many different uses for KRW Hydraulic Presses in so many different plants that we're beginning to think they can tackle just about any metalworking job that comes along. We've seen 'em do everything from simple straightening and bending jobs to compressing wispy lace threads on bobbins.

This Press, for example, is one of three in the factory of Sterling Engine Co., one of America's foremost manufacturers of marine engines. It is a 75 ton, motor-driven Hydraulic Press with a specially constructed bed for handling long pieces. Shown on the press is a crankshaft from a 4-cylinder diesel marine engine. Sometimes warpage occurs in cooling and the crankshaft is then rotated between centers on the press and checked with a special dial gauge to determine if it's "out of round". Then it is straightened accordingly. This press is also used for straightening 6 ft. camshafts, pressing on rocker arm bushings, pressing bearings in gears and straightening 8 ft. aircraft spars.

If you need a fast, versatile, accurate Hydraulic Press in your plant — one that converts in seconds from one set-up to another, give us a call. We make a full line of one, two and three cylinder Hydraulic Presses; 25-150 ton capacities; hand, air or motor driven. Write for complete specifications and prices or see your machinery dealer.

Only KRW gives you all this:

- Heavy Construction Throughout. Bed and Crown Members Truss reinforced for Added Stiffness and Strength. A KRW Exclusive Feature.
- Required Tonnage Pressure up to Rated Capacity can be Obtained Quickly and Selected Pressure Locked for Repetitive Operations.
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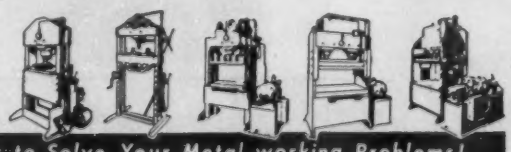

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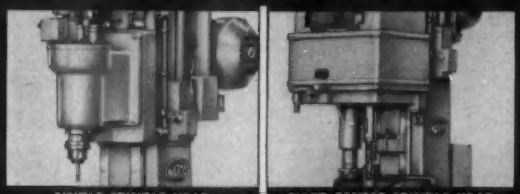
NEW FEED and CONTROL MECHANISM *increases production!*

D225H MACHINE

AVAILABLE WITH

- ✓ SINGLE SPINDLE HEAD
- ✓ ADJUSTABLE SPINDLE HEAD
- ✓ FIXED CENTER SPINDLE HEAD

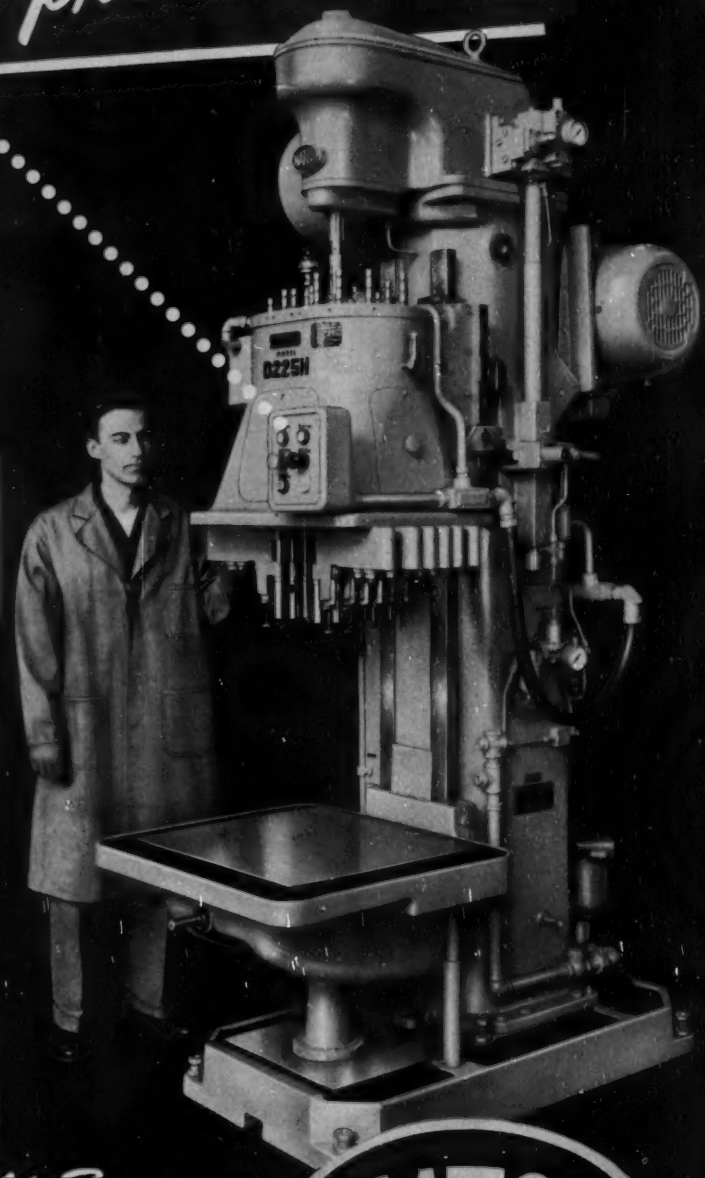


SINGLE SPINDLE HEAD — FIXED CENTER SPINDLE HEAD

...for medium size work new push button control reduces costs by speeding operations

POSSIBLE FEED CYCLES

1. STANDARD CYCLE—Rapid traverse forward, 1st or coarse feed forward, 2nd or fine feed forward, rapid reverse, stop.
2. JUMP FEED CYCLE — Additional Equipment. Rapid traverse forward, 1st or coarse feed forward, 2nd or fine feed forward, rapid reverse, stop.
3. TIME DELAY REVERSE CYCLE—Additional Equipment. Rapid traverse forward, 1st or coarse feed forward, 2nd or fine feed forward, dwell against positive stop for predetermined time, rapid reverse, stop.



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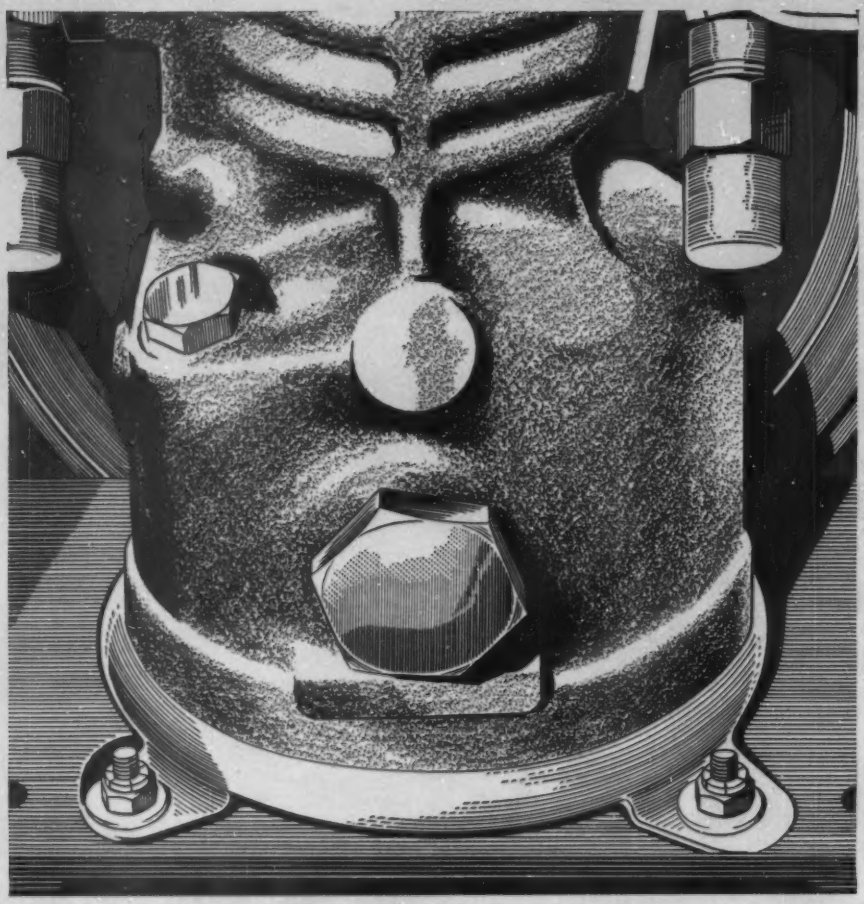
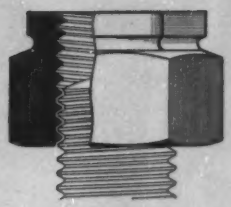


Many manufacturers use FLEXLOCS to fasten motors, compressors and other vibrating equipment to mounting plates. FLEXLOCS won't work loose . . . they eliminate costly service calls.

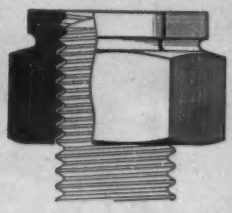
FLEXLOC locknuts reduce costly service calls

FLEXLOC locknuts do this because they stay put anywhere on a bolt as soon as their locking threads are fully engaged. Even the most severe vibration will not work them loose. FLEXLOCS offer many other advantages, too. *They are one piece.* They eliminate complicated, time-consuming methods of locking studs and bolts. They provide simpler, faster application and safer, more dependable locking than plain nuts and lockwashers, castellated nuts and cotter pins, nuts and jam nuts. They save buying, stocking and handling of extra parts. *They are all metal.* They have higher tensile strength than most other lock nuts. They permit you to stock only one nut for all temperatures to 550°F. *They are reusable.* They can be applied again and again without losing locking efficiency—a plus value in maintenance.

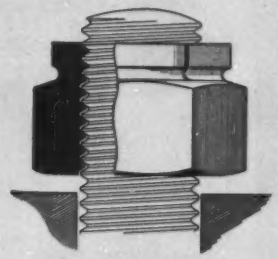
For information about FLEXLOCS and samples for test purposes, see your FLEXLOC distributor or write STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.



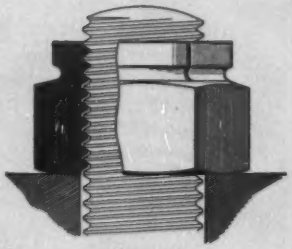
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.

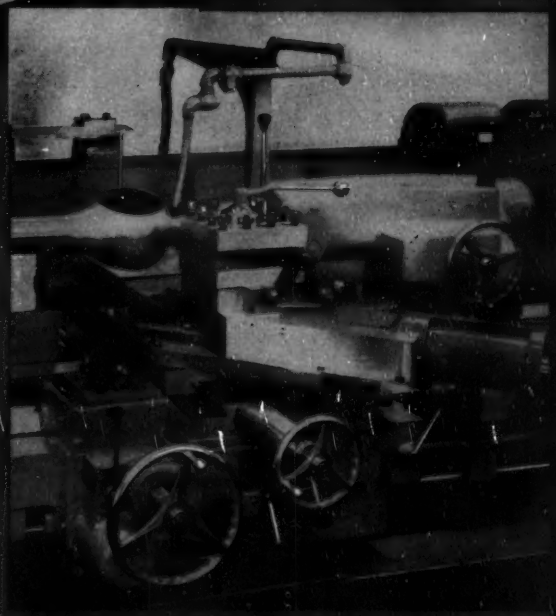


Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

FLEXLOC® LOCKNUT DIVISION

SPS
JENKINTOWN PENNSYLVANIA

2 hrs. ...versus 9½ hrs.



This marine Diesel engine connecting rod is now roughed and finished from the rough forging in exactly 2 hours. It formerly required 9½ hours to do the same job.

With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to prohibitive costs—modern, high production machinery is the answer to greater production per man hour.

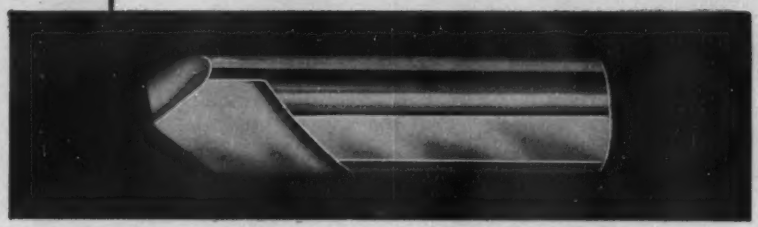
The astounding saving on this connecting rod job is the result of transferring it from previous equipment to a new 32-inch "AMERICAN" Hydraulic Duplicating Lathe. Such savings as this are not the exception but the rule when "AMERICAN" Duplicators are put on the job.

Bulletin No. 35 shows many such examples—it's yours for the asking.

THE AMERICAN TOOL WORKS CO. **Cincinnati, Ohio U.S.A.**

Lathes and Radial Drills

ATRAX IN ACTION



RECORDS SHOW 500% INCREASE IN PRODUCTION WITH IMPROVED BORING TOOL BIT

A CASE HISTORY: One of our customers had experienced considerable difficulties in boring tapered holes in stainless steel. The specifications called for extremely close diameter and taper tolerances, and a finish requirement of ten micro-inch. The carbide tool previously used gave the customer a production of one piece part, containing eight holes, per eight-hour day. With the new Atrax superior finish ground boring bit, production increased to about five piece parts per day. One tool bit roughed out and finished eight holes before resharpening was necessary, and the finished product was eight micro-inch or better. Atrax Solid Carbide Tool Bits improved production in this instance by over 500%.

Possibly our engineers or sales representatives can help YOU achieve similar savings. You'll find them in all principal cities, ready to consult without any obligation.

NEW! Complete 88-page Manual and Catalog of Carbide Tools. Write for your free copy.

THE ATRAX COMPANY NEWINGTON 11, CONNECTICUT

The third eye of inspector Harford
Inspector Emma Harford's third eye is a "Comparator," a machine that magnifies Esterbrook Renew-Points to sixty-two times normal size. It checks point outline, and width of ink slit. Variations from standard are quickly spotted, rejected and scrapped.
Searching inspections and constant attentions to quality details mean no "come-backs" from sales of Esterbrooks—and help to explain the ever-increasing popularity of this, the pen with "the right point for way YOU write."
Esterbrook
FOUNTAIN PEN
ESTERBROOK . . . America's Pen Name Since 1858
P.S.

Jones & Lamson Comparators guarantee swift, sure QUALITY CONTROL—*throughout your production lines.* Write for Catalog No. 402. One of our eleven models will fit your needs.

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JONES & LAMSON MACHINE COMPANY
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Machine Tool Craftsmen Since 1835

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New!

VARY-TALLY

Multiple-Unit Reset Counter

DESIGNED TO COUNT ANYTHING COUNTABLE

this new Vary-Tally can be supplied in any combination up to 6 banks high, 12 units wide, with the counting units arranged compactly on stands in tiers. Now check these special features of Veeder-Root design and construction:

- Easily Readable from any Angle . . . Bold Figures Always Centered in Window . . . No Glare . . . Figures not Covered by Fingers in Operation
- Easily Portable, yet Ruggedly Built for Long Wear
- Separate Counting Units Can be Rotated like Tires on a Car, to Distribute Wear Evenly
- All Parts Corrosion-Resistant
- Working Parts of Hardened Steel
- Operation Not Affected by Extreme Heat or Cold
- Individual Tag Above Each Counter-Window — Not Strip Tabs
- Veeder-Root Quality in Every Part

Now what's on *your* mind, that Vary-Tally can help you count? Write for news sheet and prices.

"The Name that Counts"

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Production Pointers from GISHOLT

GISHOLT

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

MACHINING DIFFERENTIAL CASES ON A FAST, AUTOMATIC BASIS

3 Operations Total 2.4 Minutes

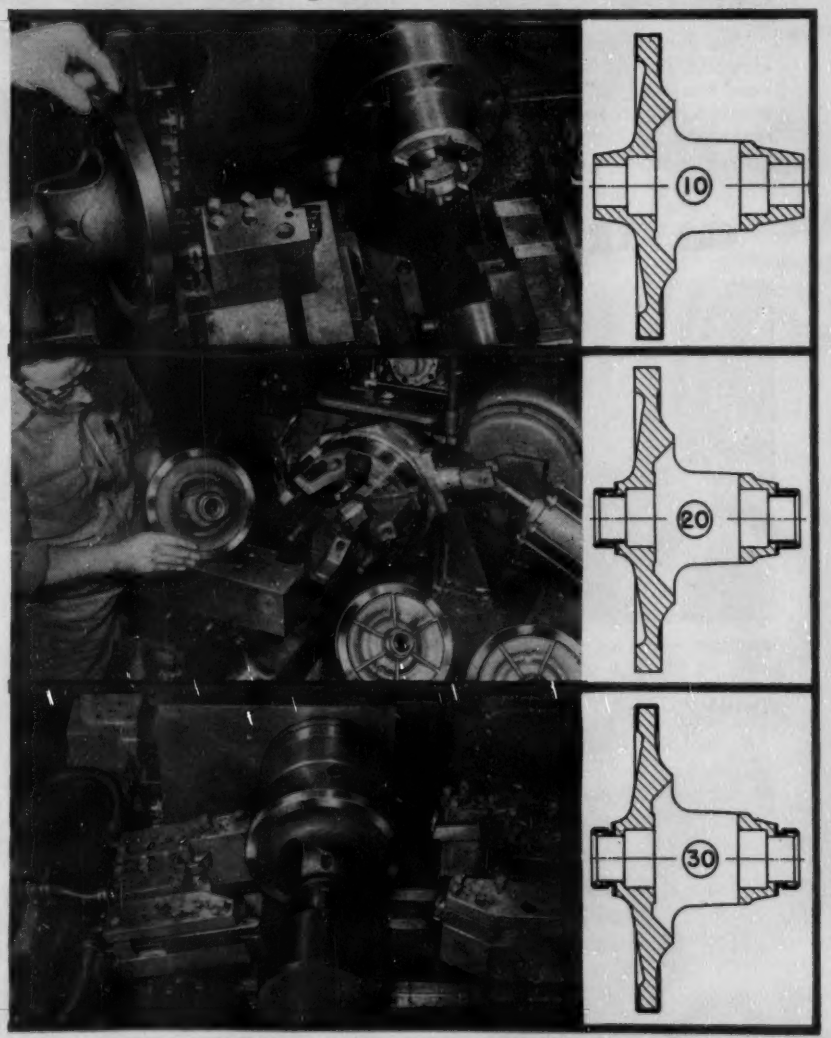
It takes three separate machining operations to turn these castings into finished tractor differential cases. To make a fast job of it, production is handled by these three No. 12 Hydraulic Automatic Lathes...and just one man.

1st Operation—0.6 Minutes
This rough machining prepares parts for holding and locating in subsequent operations. Bell-type centers in the tailstock and spindle line up hub diameter at each end. Longitudinal location is taken care of by a positive stop. A single tool on the front carriage turns the flange, while two tools on the rear slide straddle face.

2nd Operation—0.9 Minutes
Part is now held on OD with a Gisholt-Barker air-operated chuck. This chuck leaves the spindle open to carry tools to bore, face, turn and chamfer the hub. Similar tools mounted on the front carriage handle the same surfaces on the other end.

3rd Operation—0.9 Minutes
Workpiece is held back and driven with an air-operated clamp and a serrated C-washer. Tools on front carriage turn both hubs, as well as finish turn the flange OD and chamfer both corners. Tools on the rear slide form the grinding relief, chamfer both hubs and finish straddle face the flange.

These complex parts, with 16 inside and outside surfaces at both ends, are machined in a rapid, pass-along sequence.



THE AMAZING VERSATILITY of this machine is illustrated by 28 different jobs in the *No. 12 Hydraulic Automatic Lathe* catalog. Write for your copy.

GISHOLT

TIME-SAVING IDEAS

HOW GOOD "HEAD" WORK MAKES THIS A ONE-PASS OPERATION

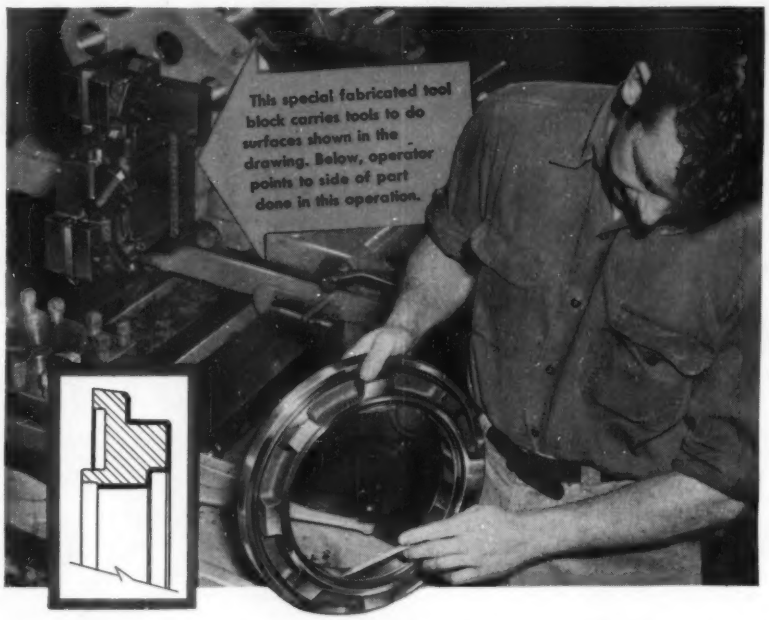
Combined Tooling Saves Time

It's heavy work with plenty of metal to be removed in the machining of these flanged ring steel forgings. So there's 60 horsepower put into the 3L Saddle Type Turret Lathe that does the job.

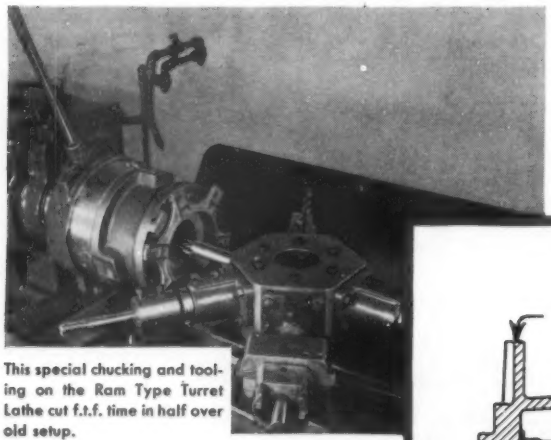
A newsworthy feature of the setup—and a good point to remember for your own work of this kind—is the massive combination tool holder which carries seven tools. Securely mounted on the hexagon turret, this special head combines tools for plunge cutting the surfaces shown in the drawing in a single pass. Floor-to-floor time is 2.5 minutes, much faster than what it would be with a conventional tooling arrangement.

You can be sure that the tools mounted in this strong, fabricated head are there to "stay." There's no overhanging of tools this way, no springing problems. Work of this kind, to do it right...and fast...takes plenty of power and rigidity in a machine. They have it here in the rugged Gisholt 3L Saddle Type Turret Lathe.

By combining 7 tools in one special head, all surfaces are handled in one powerful plunge cutting operation.

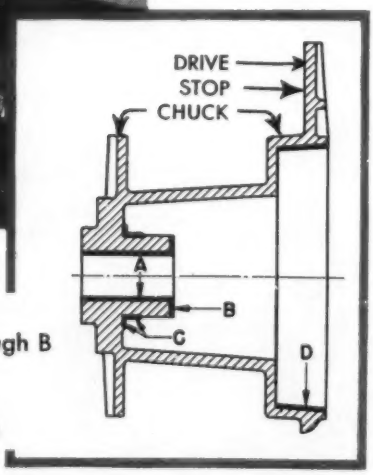

This special fabricated tool block carries tools to do surfaces shown in the drawing. Below, operator points to side of part done in this operation.

CLEVER CHUCKING IDEA HELPS DOUBLE PRODUCTION



This special chucking and tooling on the Ram Type Turret Lathe cut f.t.f. time in half over old setup.

Also Assures Concentricity of Long Workpiece



Station 1—Rough A
Station 2—Finish A, rough B
Station 3—Ream A
Station 4—Rough C-D
Station 5—Finish B-C-D

Here the production trick is holding these cast-iron hub spiders. Because of the long overhang, chucking had to be planned for support at both ends of the workpiece. Yet, fast loading and unloading were a must, too.

All problems are nicely solved by the No. 5 Ram Type Turret Lathe equipped with a 3-jaw Gisholt-Barker Wrenchless Chuck. This provides for fast loading operations, and yet allows a large enough bore to carry a pilot bushing for added support during boring.

A special fixture locates and drives at the spider end. Chuck jaws, free to move through openings at the back of the housing, hold on the small flange end. Balanced and piloted tools on the hexagon turret handle all the surfaces shown.

Time on this machine with good tooling and chucking is now only 3.2 minutes—just half the time of the former method.

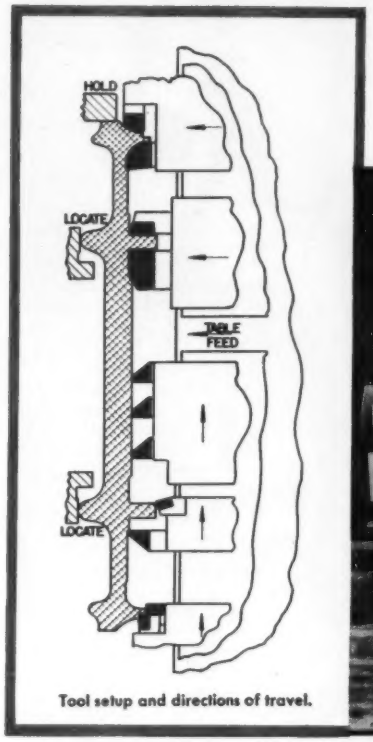
Here, fine, fast chucking with good tooling for rapid stock removal has doubled production.

GISHOLT

TIME-SAVING IDEAS

MANY SURFACES AND SIZES NO PROBLEM...*THIS WAY*

Simplimatic Provides Automatic Operation on Jet Engine Part



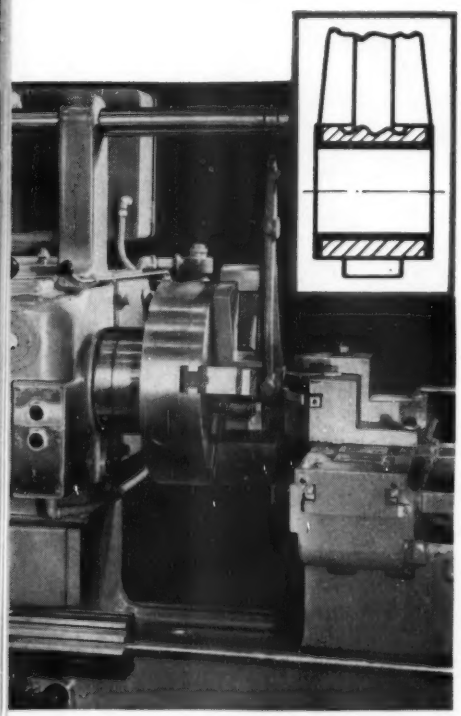
Tool setup and directions of travel.

Setting up this jet engine job had its problems: how to handle the many surfaces of the compressor discs in nine different sizes.

The solution was provided by a Simplimatic Automatic Lathe. Seven tools on the front slide feed longitudinally to depth and then across for facing and turning. Four tools on the rear slide move longitudinally to finish the turning and boring and to form the four radii. A 50-horsepower driving motor is required. Floor-to-floor time is approximately 13 minutes.

The drawing shows how each slide with its group of tools feeds at its own direction and rate of feed. This permits you to get more combinations of surfaces in a single tooling setup. It's the reason why so many different jobs can be handled on the Simplimatic—and at a cost far below that of a special machine.

Nine sizes of similar parts are easily handled by simply repositioning tools in the T-slots using the same slide positions and motions.



Close-up shows chucking detail. Front and back faces and the ID are machined in one operation.

GOOD TIPS IN HOLDING AND MACHINING BIG-SWING PARTS

Fastermatic Provides Efficient Production of 18 Similar Workpieces

There's more here than meets the eye. While the drawing shows simple multiple machining, there are definite problems in holding this part (and seventeen others) having considerable swing.

To do the job in one fast, automatic operation a 1F Fastermatic Automatic Turret Lathe was chosen because of the multiple passes it makes possible. To take care of the big swing, the lathe bed was gapped as shown.

The real problem—of holding the various parts without going into special, expensive fixtures—was solved by a 2-3 jaw convertible chuck. Chucking is done with either two or three jaws, depending upon available chucking surfaces. To get a firm grip on the contoured chucking surfaces, jaw inserts are used.

There is simple turret and cross slide tooling with a back-facing attachment mounted inside the spindle. This permits doing all surfaces from both ends in a single, completely automatic cycle. Floor-to-floor time for a part with an 18″ swing is 4.7 minutes. The other seventeen parts are handled just as efficiently.

An unusual job with smart chucking permits machining these awkward, long-armed parts complete in one operation.

GISHOLT

GISHOLT

TIME-SAVING IDEAS

SUPERFINISHER MOUNTS ON GRINDER

...SAVES REFINISHING COSTS

Smooth Surfaces Make Pump Piston Rods Last Longer

Here is a fresh approach to an old problem—rebuilding worn pump piston rods.

First, the piston rod—from a reciprocating chemical pump—is placed in a grinder. The long shaft is then ground down to the top limit of undersize dimension. At this point, the surface finish measures approximately 15 micro-inches. The grinding wheel is retracted and with a No. 3 Superfinish Attachment mounted on the grinder, the surface is quickly Superfinished down to 5 micro-inches. Work is done in lots of six to ten pieces.

Two important benefits result: finishing time is cut in half with very little cost for new equipment; greatly increased service life is achieved with far less seal replacement.

In this better way of refinishing pump piston rods, money is saved by the (1) low-cost Superfinisher attachment mounted on existing equipment, (2) reduction in finishing time, and (3) for longer service.

Close-up photograph shows Superfinishing attachment mounted on existing equipment. Note long length of shaft.

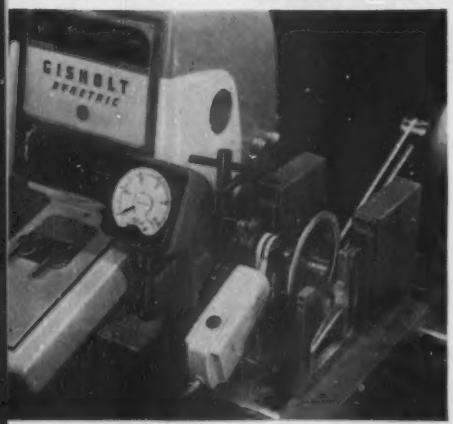
NEW!

YOURS FOR THE ASKING

New Superfinishing Catalog gives clear, concise explanation of this important process; reports on and illustrates numerous applications; shows how time, money are saved. Write for your copy.

HOW "FORCE" UNBALANCE IN ASSEMBLY IS LOCATED AND MEASURED

Correction Made by Addition of Single Weight



Improved 1SB Bench Model Balancing Machine with workpiece loaded.

Precision balancing amounts to a real sales advantage in this case... vacuum cleaners. The manufacturer first dynamically balances the armature and then the armature-impeller assembly. Long life with smooth, quiet operation is the result.

Production is handled on a Gisholt 1SB Bench Model DYNETRIC Balancer. In this case, because the impeller is small in axial length compared in diameter, major unbalance after assembly with the armature will be *force* (static) unbalance, as opposed to *moment* (dynamic) unbalance.

The assembly is placed in a special cradle which permits it to rotate on its own bearing surfaces. Amount of force unbalance is shown on the direct-reading Amount Meter; and angular location is simultaneously indicated on the numbered band by the stroboscopic lamp unit.

Correction of force unbalance requires the addition of a single correction weight. Time in making correction is therefore saved by the Gisholt Balancer because it provides separate measurement of force and moment unbalance. On jobs where moment unbalance stops within an established tolerance for most pieces in the lot, this kind of operation results in even lower balancing costs.

By showing force unbalance separately, correction time is saved by Gisholt Dynetric Balancers.

DYNETRIC BALANCERS GISHOLT

No. 5-654
625

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

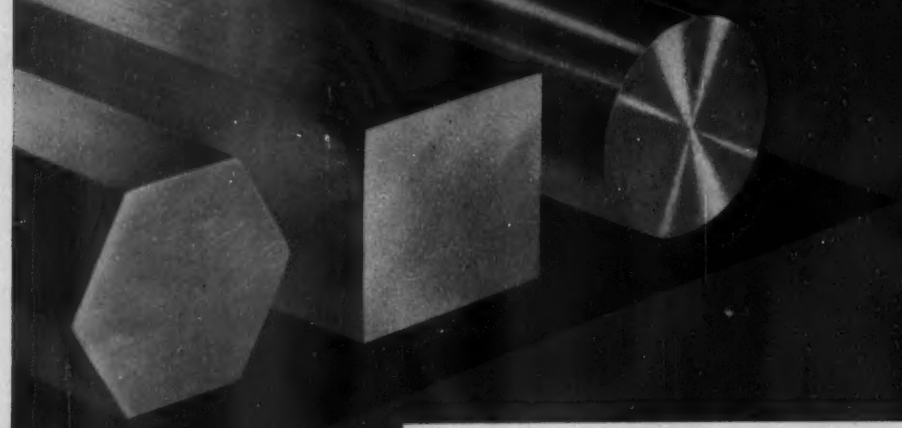
Write for your copy of Gisholt's new general catalog.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

"J&L 1200"

COLD FINISHED CARBON STEEL



It's tops

"J&L 1200" Steel provides the qualities that help machine operators do top-flight work at lower overall costs. With "J&L 1200," the operator obtains: *better machine finishes . . . longer tool life . . . higher rates of speed.* This fact has been proven time and again—in shop after shop.

"J&L 1200" grades meet the compositions published by the A.I.S.I. . . . S.A.E. . . . and Federal Specifications QQS-633.

Try this steel in your own shop. Results will convince you "J&L 1200" deserves to be a regular specification for your production runs.

tops
tops
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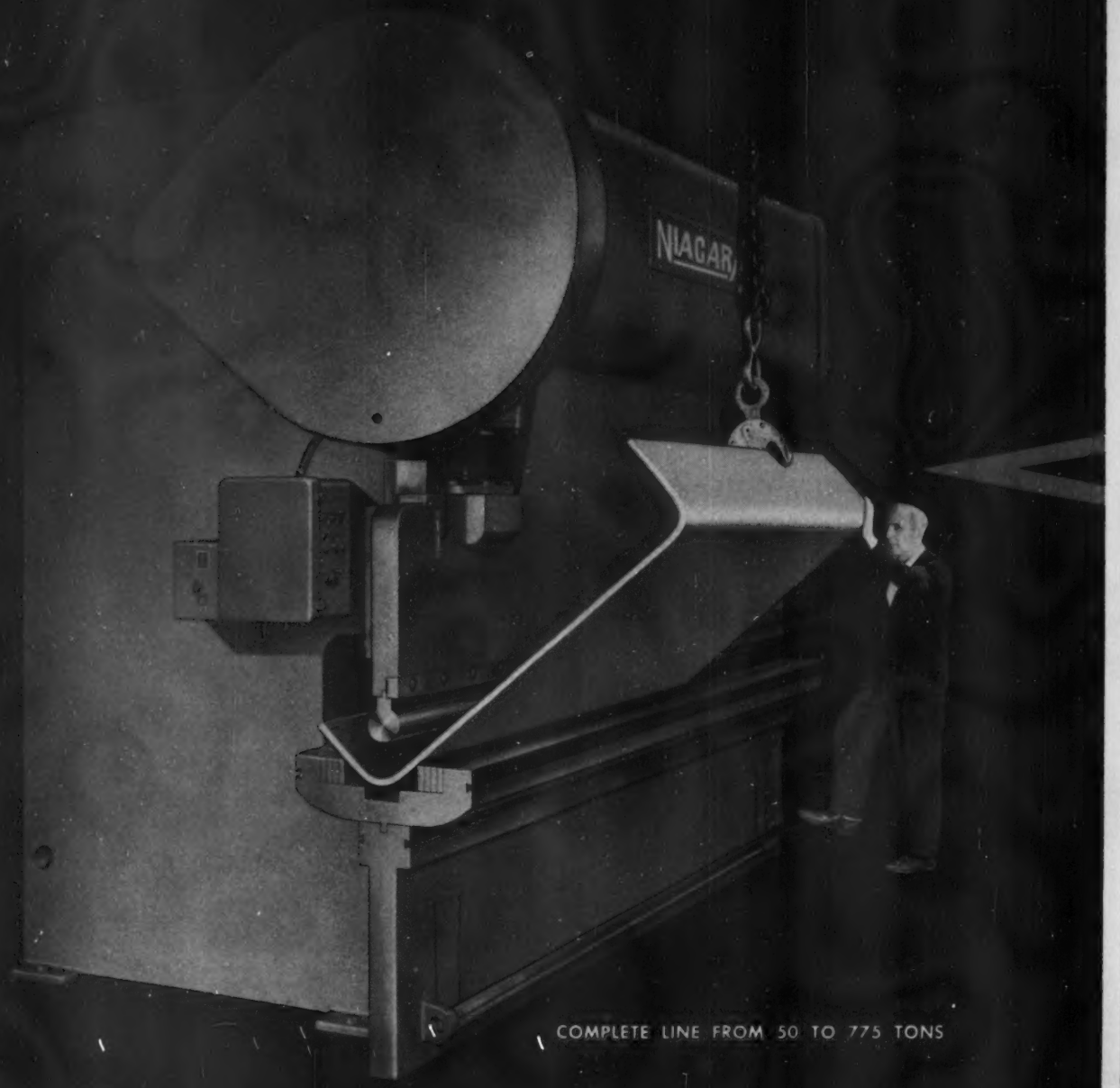
J&L STEEL

Jones & Laughlin
STEEL CORPORATION — Pittsburgh

IT'S THE NEW, "YEARS-AHEAD" LINE...

Far out front on every point of comparison



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America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

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ALL STEEL PRESS BRAKES

"MULTI-MACHINE" VERSATILITY TO BOOST PRODUCTION

Practically limitless in their scope of forming, bending, punching, blanking and related operations, Niagara Press Brakes get more done for you because they do more jobs. One reason: Advanced design. Another: The extensive line of Niagara Press Brake Dies available.

UNIFORM BENDS WITH STRAIGHT-EDGE ACCURACY

Double end twin drives with double reduction gearing, *on all models*, provide uniform, constant application of power at both ends of the ram. Off-center loading presents no problem.

Rugged, streamlined frames feature box type crowns of unequaled strength and rigidity, assuring maximum resistance to deflection and permanent alignment of bearings and ram.

3-SHIFT STAMINA TO HANDLE WORK-HEAVY SCHEDULES

Close attention has been given to every design detail. Nothing has been overlooked. Each frame size has been scientifically tested to detect and eliminate harmful stresses at all critical points.

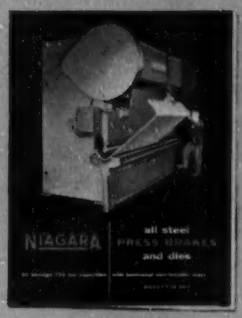
Laminated non-metallic ways, an exclusive Niagara feature, reduce wear to an absolute minimum, providing accurate alignment and longest possible service life. All gearing is totally enclosed in sealed oil baths for thorough, clean lubrication.

Once again, Niagara's forward-thinking engineering has produced a metal working machine years ahead of its time. As you become familiar with the significant developments embodied in this revolutionary new line of all steel press brakes, you will realize why it carries the Niagara nameplate. After all, who is more uniquely qualified to be its builder than the builder of America's most famed and most complete line of presses, shears, other machines and tools for plate and sheet metal work?

Call in your nearest Niagara representative at once. Let him tell you, *in detail*, what these great, new press brakes can do for you.

CHECK ALL THE FACTS, YOURSELF!

Compare. Make a careful, feature-by-feature appraisal of Niagara's years-ahead press brake design. Write for new Bulletin 89C . . . the most comprehensive press brake literature ever published.



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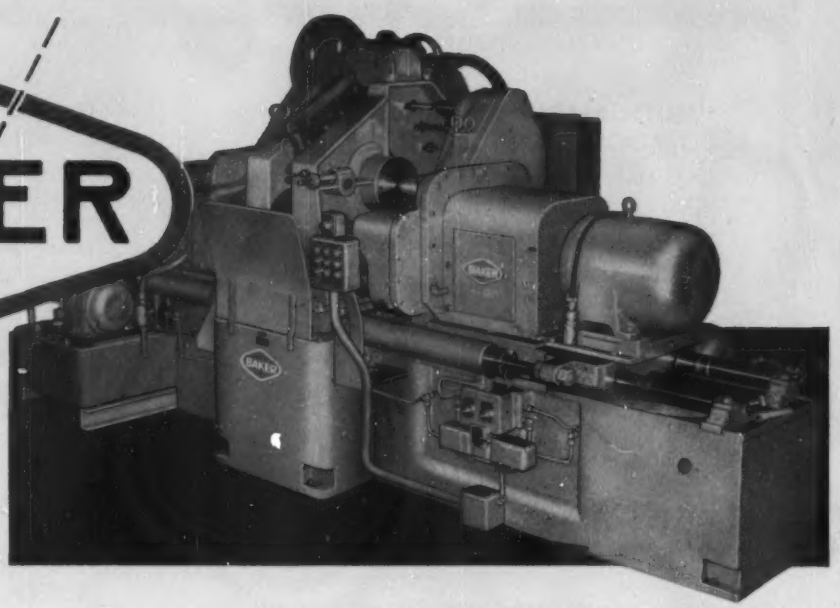
Modern Machine Tools..

SLASH PRODUCTION COSTS!

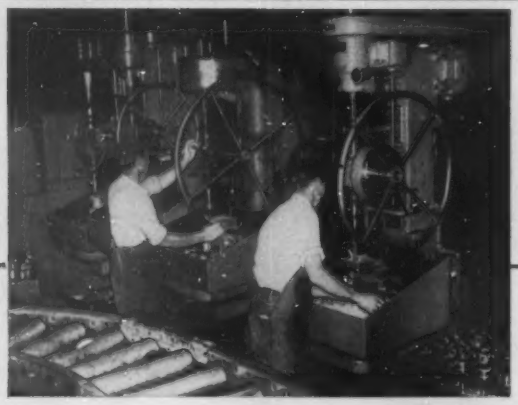
New
BAKER
Method



1 Operator . . .
1 Machine . . .

Multi-Operations Fully Automatic On 4 Parts Simultaneously—Load—Drill—Core Drill—Ream—Unload

THE OLD METHOD—



2 OPERATORS . . 4 MACHINES . .

Hand Controls + Excessive Handling + Capstan And Hand Engagement Of Feed + Operator Fatigue = Low Production Rate At High Cost.

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with a NEW BAKER 'Special'

WRITE REGARDING YOUR SPECIFIC JOB PROBLEMS...

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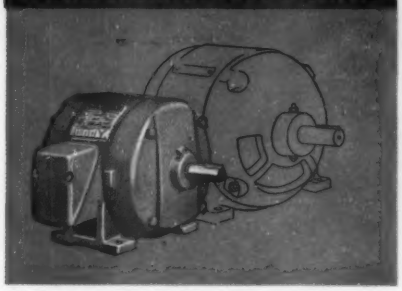
8 reasons why you should

MODERNIZE EQUIPMENT WITH TRI 55 CLAD MOTORS

REG. U.S. PAT. OFF.

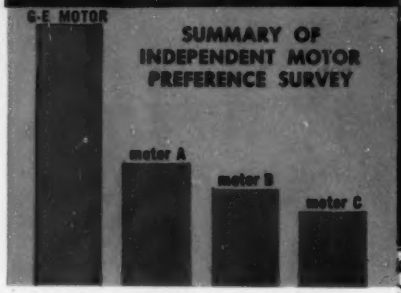
Plan now to modernize your equipment with the all-new General Electric Tri/Clad '55' motor, available now in many ratings; entire line of 1 to 30 hp a-c motors available soon. Contact your G-E Representative. General Electric Company, Section 648-6, Schenectady 5, N. Y.

MORE POWER PER POUND



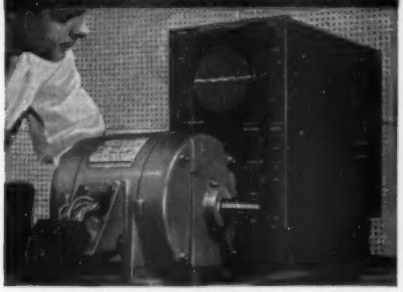
Lighter and smaller Tri/Clad '55' motors in new NEMA frame sizes and ratings save you space and weight, reduce handling costs.

BUYER PREFERENCE



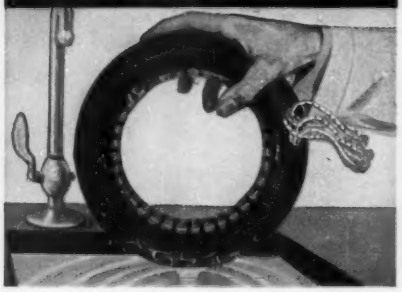
You take advantage of a 2 to 1 buyer preference for the electric motors on your equipment when you buy or specify a G-E motor.

BETTER PERFORMANCE



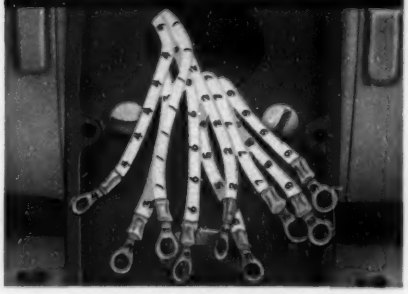
Quieter operation, proved by sound-room tests, is typical of the many performance improvements in the new G-E Tri/Clad '55'.

LONGER LIFE



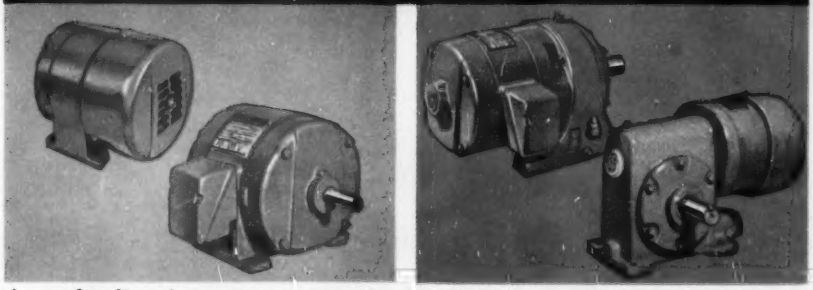
A silicone Dri-film* coating makes insulation shed water—lengthens motor life. Polyester-film insulation is 8 times stronger.

EASIER INSTALLATION



Perma-numbered leads are always instantly read even when wires are taped or clipped. Conduit box has plenty of knuckle room.

COMPLETE LINE OF NEW MOTORS



A complete line of new motors assures the right electrical drive for your machine. Write for Bulletin GEA-6013 on dripproof motors, GEA-6012, on enclosed motors. For low speed jobs, G.E. offers a complete line of gear-motors. Write for Bulletin GEA-6027.

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Progress is our most important product

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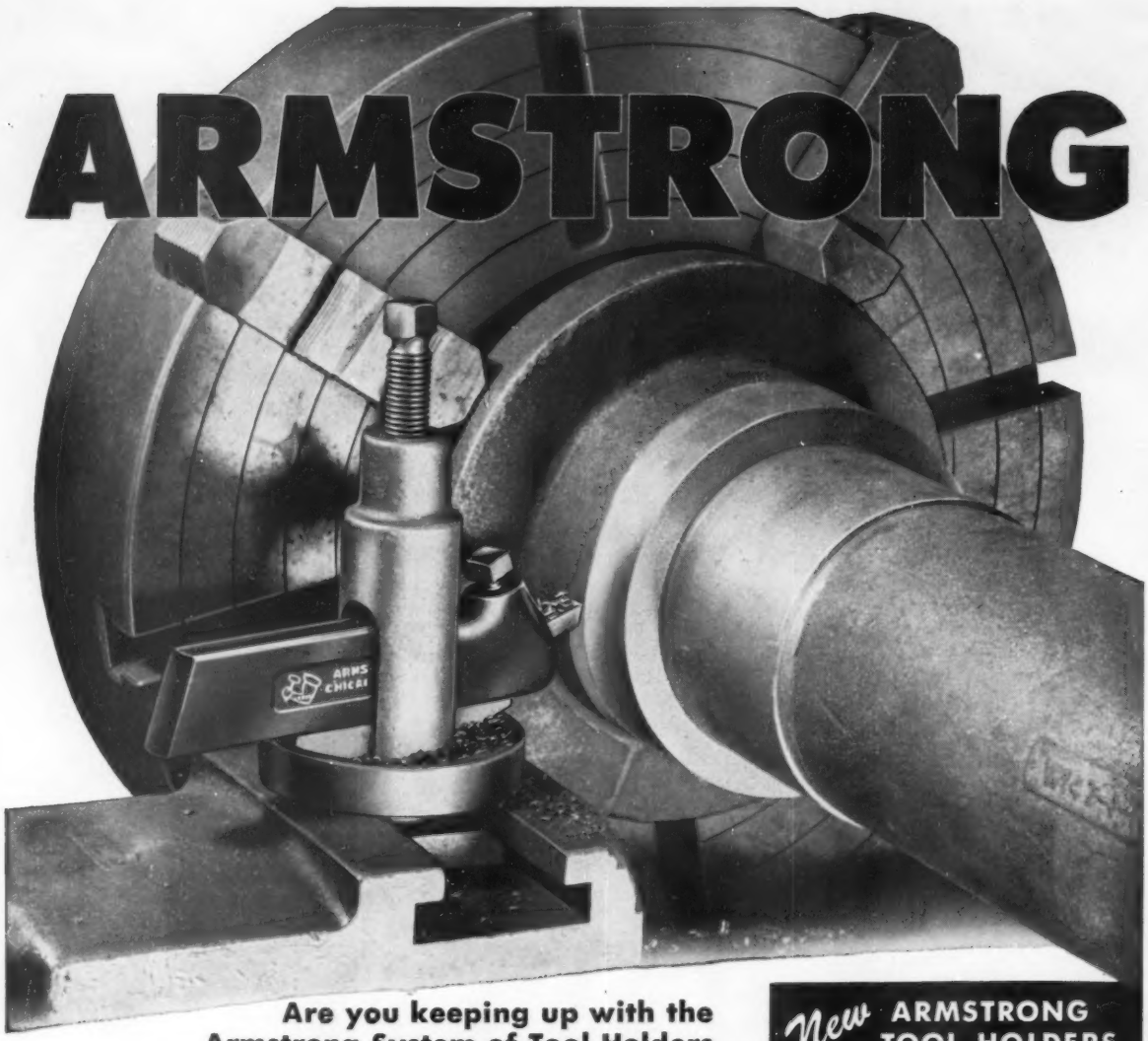

Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

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ARMSTRONG Spring Form Threading Tool Holder
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compare costs...When you figure your initial cost of BRAD FOOTE deep case hardened gears on the basis of 50% longer life (and less down time and maintenance labor), you will find that these gears are more economical to use.

ask for a quotation...Send us your specifications, so we can quote you on deep case hardened BRAD FOOTE Gears. Then order a set to put to test on the toughest job you have. Let them prove to you that deep case hardening, BRAD FOOTE's controlled deep case hardening and minimized distortion, increases gear life 50%.

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Operator determines dew point of protective atmosphere in hardening furnaces. Microcarb control in background maintains uniform carbon concentration inside carburizing furnaces.
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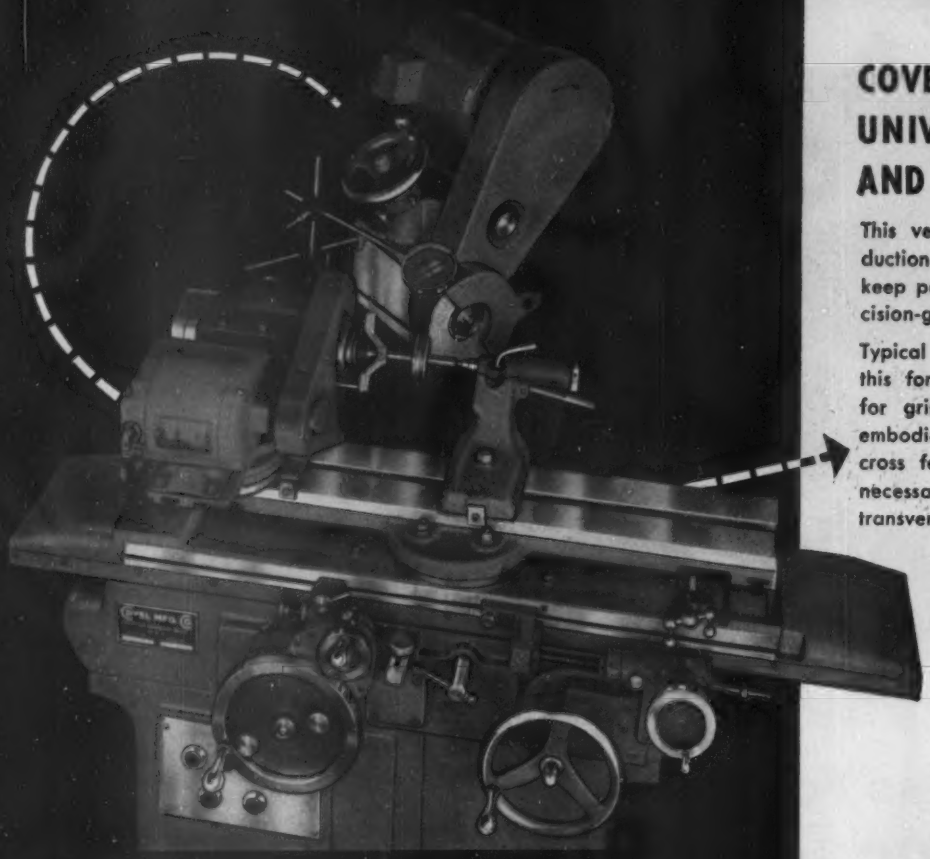

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This versatile machine can get production off to a flying start — and keep pace with a steady flow of precision-ground, highly efficient tools.

Typical of No. 12's *universal* scope is this form grinding attachment set-up for grinding circular form tools. It embodies fine longitudinal feed—fine cross feed; for the extreme accuracy necessary for both longitudinal and transverse movement.

Write for
12-page detailed
Bulletin AM-134

PRODUCTION *Starts* IN THE TOOL ROOM

Look to your tool room — where production starts — and see whether your tool-makers and set-up men are hampered by obsolete, inaccurate and wasteful grinding equipment. Poorly ground tools and cutters handicap production every step of the way — through inferior results, costly rejects, loss of valuable time, expensive tool waste.

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No matter how keen the competition, there can be only one winner. And the difference between the winner and the runner-up, whether it's golf or making high speed steels, is measured in performance.

Crucible REX® high speed steels have proved their championship qualities under the toughest sort of competition — in actual use in thousands of tool shops throughout the world. But check for yourself. Try a piece of REX high speed steel on your next job. Compare its hardenability, response to heat treatment, its fine tool performance. You won't find another high speed steel to outperform REX.

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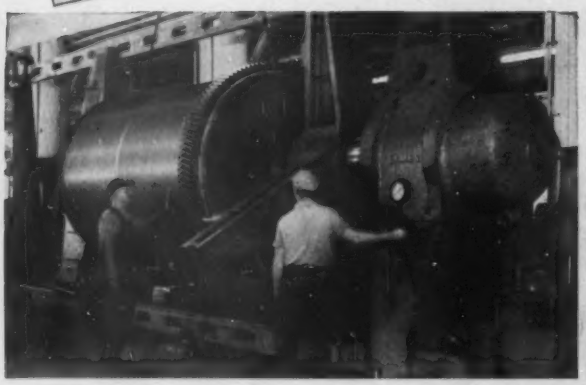

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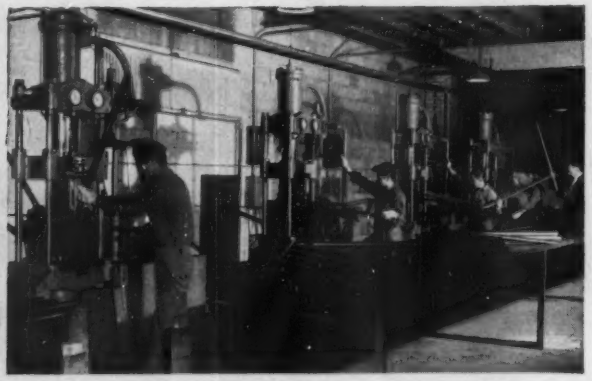
"Our Elmes 500-Ton Inclined Forcing Press makes possible 50% savings in costs of gear installations on crane hoisting drums." (Illustrated—hoisting drum for 400-ton ladle crane.)



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"Four Elmes Tube Bending Presses produce 2000 tailpipes per 8-hour shift. Each tailpipe requires seven bends."

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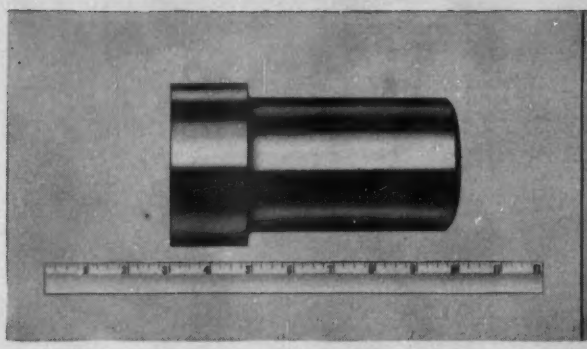
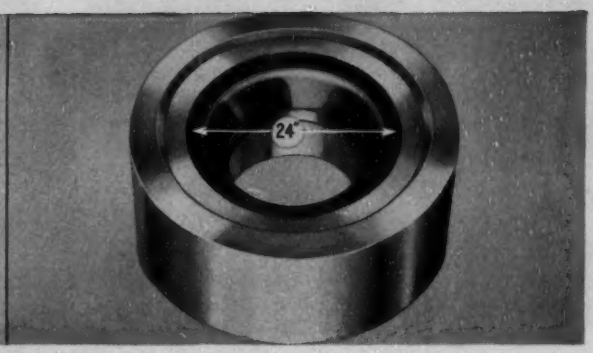
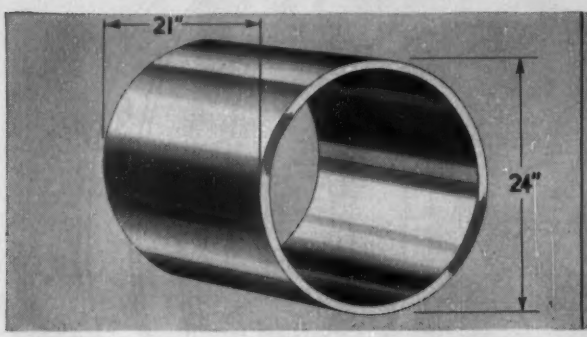


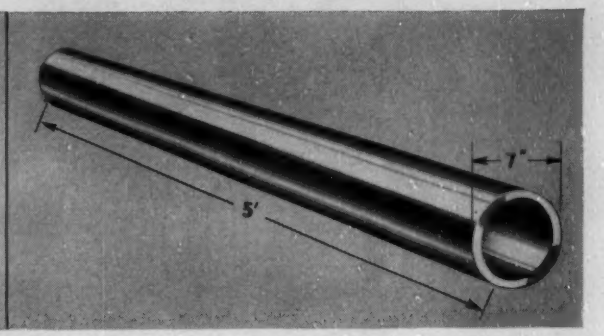
Solid carbide punch used in the cold extrusion of steel.



Ring dies up to 24" I.D. produced one piece.



Carbide cylinders up to this size produced one piece.



Carbide cylinders up to this size produced one piece.

2-Ton Cemented Carbide pieces can solve your toughest wear problems

New manufacturing facilities at the Carboloy Department of General Electric Company are capable of producing pieces of cemented carbide up to 4,000 pounds, including—

large die sections
rolls for rolling strip steel
large punches for cold extrusion work
large, wear-resistant linings for brick molds

When you replace present parts—large, medium size or small, with Carboloy cemented carbides, maintenance costs come down, production goes up.

Carboloy engineers are ready to assist manufacturers and diemakers to determine where and how Carboloy cemented carbides can cut costs, boost production. Write for this free service.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

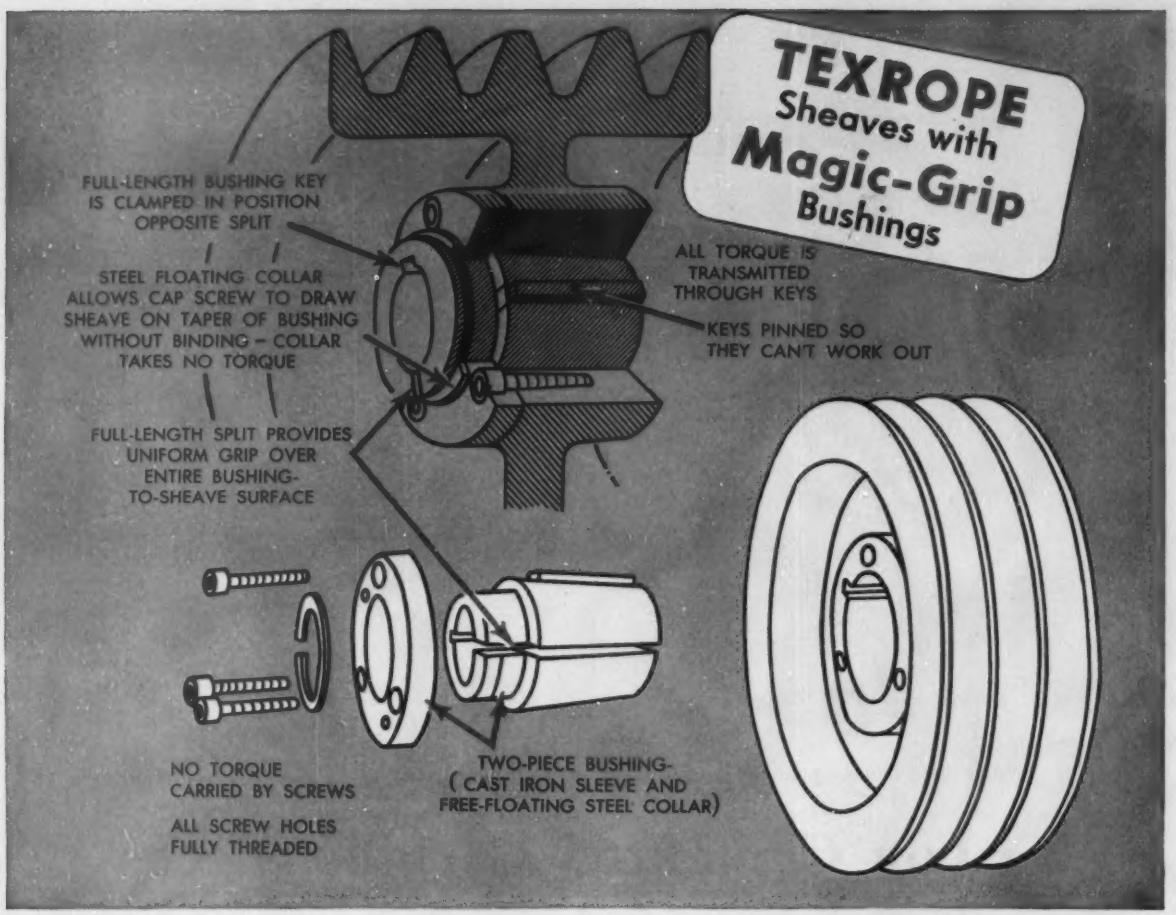
Carboloy, Department of General Electric Company
11149 E. 8 Mile Ave., Detroit 32, Michigan

Gentlemen:
Could large pieces of cemented carbide reduce costs in the following applications:

_____
_____
_____
_____

Please have a Carboloy engineer—
☐ call at plant.
☐ call for appointment.

Name_____
Title_____
Company_____
Address_____
City_____ Zone____ State_____


TEXROPE
Sheaves with
Magic-Grip
Bushings
FULL-LENGTH BUSHING KEY IS CLAMPED IN POSITION OPPOSITE SPLIT
STEEL FLOATING COLLAR ALLOWS CAP SCREW TO DRAW SHEAVE ON TAPER OF BUSHING WITHOUT BINDING – COLLAR TAKES NO TORQUE
FULL-LENGTH SPLIT PROVIDES UNIFORM GRIP OVER ENTIRE BUSHING-TO-SHEAVE SURFACE
ALL TORQUE IS TRANSMITTED THROUGH KEYS
KEYS PINNED SO THEY CAN'T WORK OUT
NO TORQUE CARRIED BY SCREWS
ALL SCREW HOLES FULLY THREADED
TWO-PIECE BUSHING- (CAST IRON SLEEVE AND FREE-FLOATING STEEL COLLAR)

Get the Only Sheave with ALL the Most Needed Features

Here's Comparison of *Magic-Grip* Sheave and Other Sheaves

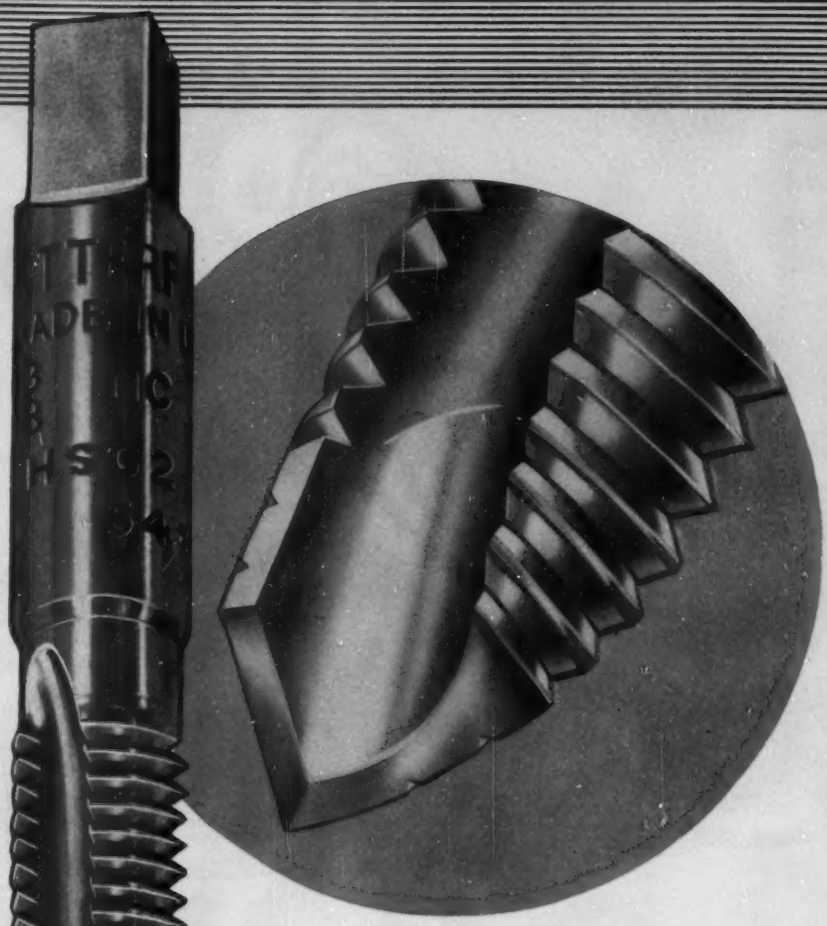
	Magic-Grip Sheaves	SHEAVE A	SHEAVE B	SHEAVE C
Bushing fully split for uniform clamping action.	Yes	Yes	No	Yes
Load carried by keys instead of threaded bolts.	Yes	No	No	No
Bushings cover full range of NEMA "probable" shaft diameters.	Yes	Yes	Yes	No
All screws engage full thread.	Yes	Yes	Yes	No
Mounts in one piece.	Yes	No	Yes	Yes
Squares itself with shaft.	Yes	No	No	No

A-4147

Texrope and Magic-Grip are Allis-Chalmers trademarks.

ALLIS-CHALMERS

MILWAUKEE 1, WISCONSIN

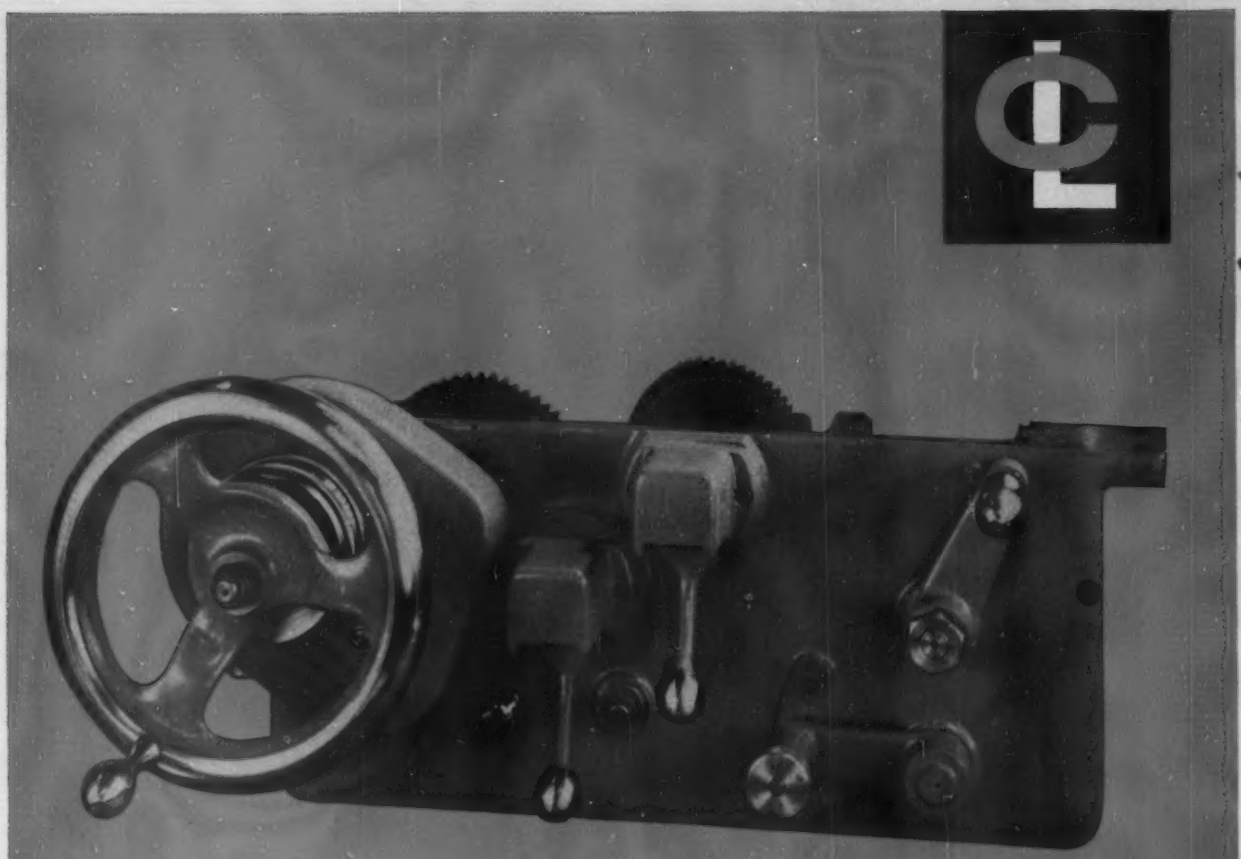


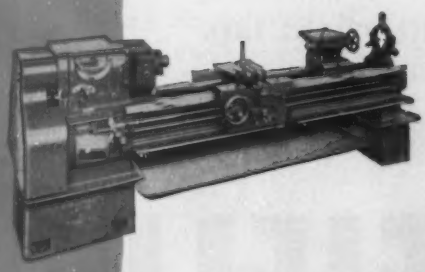
No matter what the job demands, you just can't beat the performance of a Butterfield tap.

BUTTERFIELD

UNION TWIST DRILL COMPANY
BUTTERFIELD DIVISION
DERBY LINE, VERMONT, U.S.A.
TAPS • DIES • DRILLS • REAMERS • COUNTERBORES • SCREW PLATES

FOR BETTER SERVICE
CALL YOUR
BUTTERFIELD
DISTRIBUTOR





1. All-geared headstock
2. 12 spindle speeds in geometric progression
3. One-shot lubrication of carriage ways and cross slide
4. Ground bedways (flame hardened at extra cost)
5. Tapered key drive spindle nose
6. Multiple-disc clutch and brake
7. 32 thread and feed changes
8. Forged steel spindle and all headstock shafts mounted in precision antifriction bearings

For complete catalogs, prices and name of your local dealer, write on company letterhead to Cincinnati Lathe & Tool Co., 3246 Disney, Cincinnati 9, Ohio.

A Quality Lathe Apron

A glance tells you it's built for convenience and safety. There are two spindle start-stop levers, one located on the apron, for ease of operation. The chasing dial is built in. The independent drop levers for cross and longitudinal feed, lift to engage. This disengages feed if an object falls on them. For extra convenience, the oil shot plunger is also located on the apron.

is Standard on 16" Cincinnati LT Lathes costing only $4829*

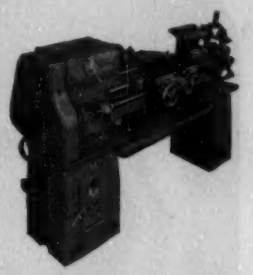
The wide range of work these lathes will handle, plus their low initial and maintenance costs, assures a fast return on your investment. They are the only low-priced lathes in their class with high-priced features:

*16" x 30" including motor and controls F. O. B. factory. Prices subject to change without notice. Direct reading length dial shown is available at extra cost.

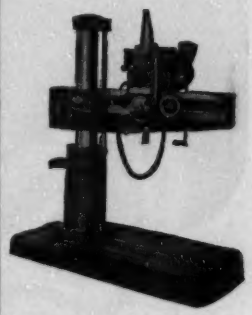
center on . . .

cincinnati lathes and drills

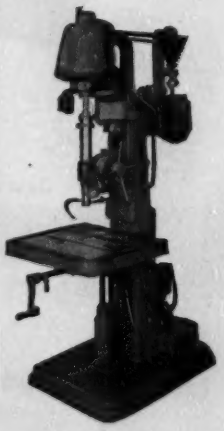
There is also a complete line of Tray-Top Lathes and Cincinnati Floor, Bench and Radial Drills



Light-duty Tray-Top Lathes (10" to 18" swing)

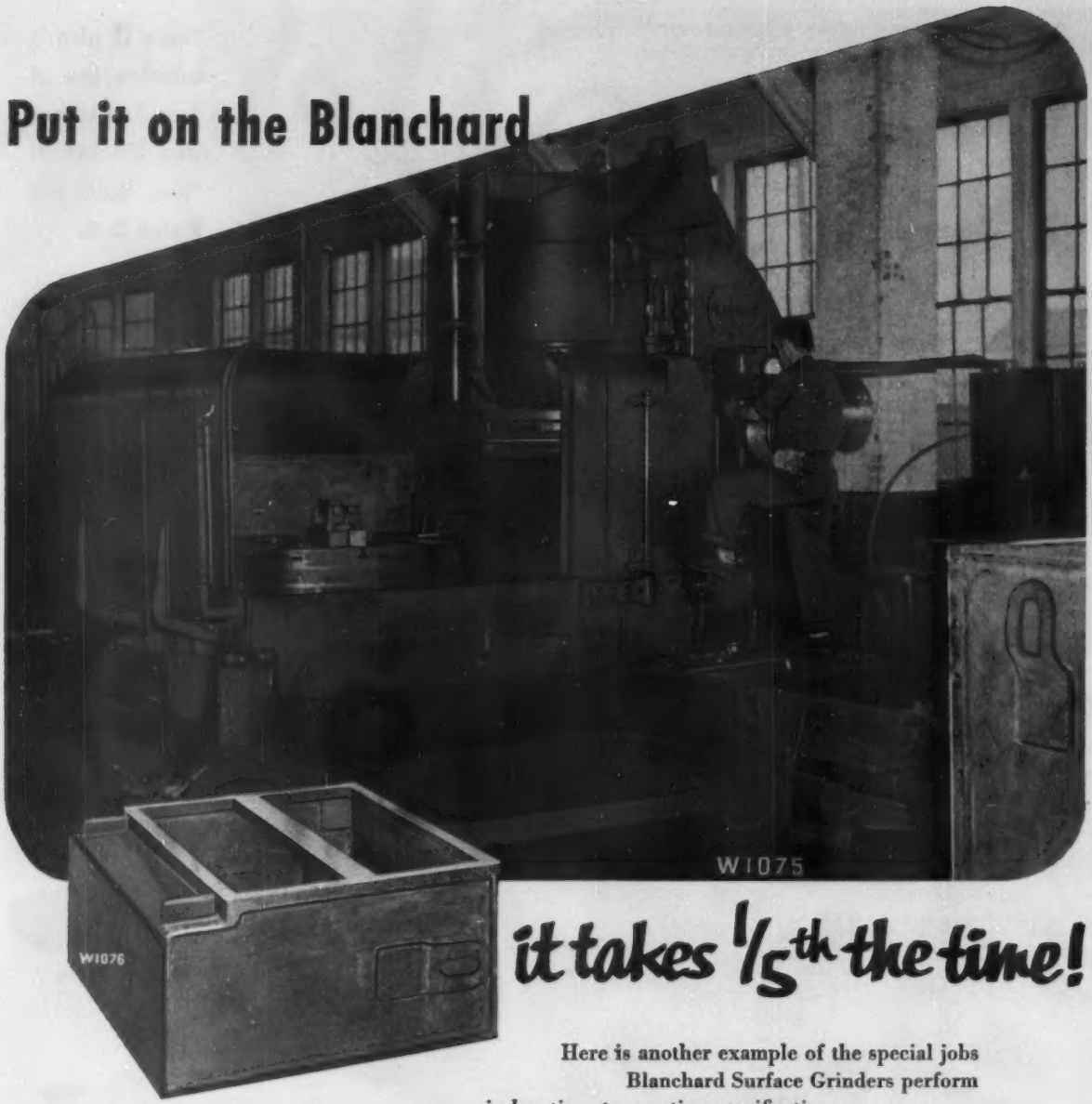


Radial drills (3' arm, 7" column)



Drilling machines, floor and bench (sizes 16", 18" and 21", illustrated, 21" slider)

Put it on the Blanchard



it takes 1/5th the time!

Here is another example of the special jobs Blanchard Surface Grinders perform *in less time,* to exacting specifications.

These explosion-proof control cases are used in the coal mining industry. Each steel weldment case is 36" x 48" x 24" deep. Because gaskets cannot be used, surface finish, and flatness must provide a dust and gas explosion-proof metal seal.

A Blanchard Surface Grinder, the No. 32-60, removes approximately 1/8" of stock — in *one-fifth* the machining time formerly required.

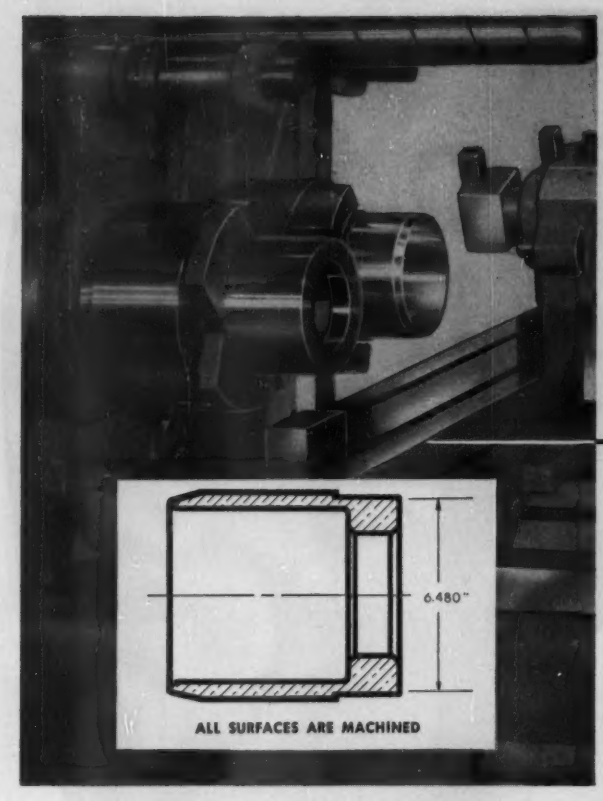
Send a sampling of your parts for free test grinding and our recommendations.

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "Art of Blanchard Surface Grinding".

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.



TWO-SPINDLE *Automatic Turret Lathe* DOUBLES PRODUCTION

THIS BRONZE CASTING COMPLETELY FINISHED

. . . in one turret cycle

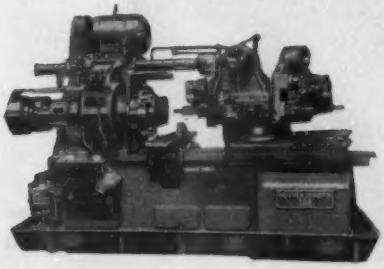
. . . in 4.48 minutes

(FLOOR-TO-FLOOR TIME)

WITH A

5D-2 POWER-FLEX Automatic Turret Lathe plus P & J Tooling

To get more production per unit of floor area, consider the P&J 2-Spindle Automatic Turret Lathe. With double spindles driven from a common power source, this machine far exceeds the output of any single-spindle type for work within its range. And you'll cut costs *FOUR WAYS*. One P&J 2-Spindle Machine uses far less power . . . costs far less initially . . . takes half the floor space . . . and is easier to operate.



Consider also features of the 5D-2 POWER-FLEX common to all P&J turning machines — automatic chucking, automatic speed and feed changes — ample power, rigidity and flexibility — time-proved construction that assures accuracy and long life, more return from your original investment.

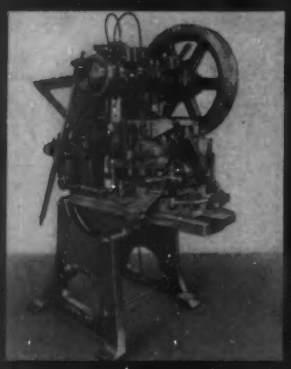
See for yourself how the 5D-2 POWER-FLEX can bring greater profits to your plant. Send today for your copy of Bulletin 123 — or ask P&J Engineers to submit tooling recommendations based on your own prints or sample parts.

MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

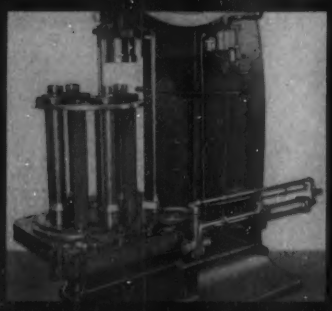
POTTER & JOHNSTON Co.
PAWTUCKET, RHODE ISLAND
SUBSIDIARY OF
PRATT & WHITNEY
DIVISION NILES – BEMENT – POND COMPANY

P&J

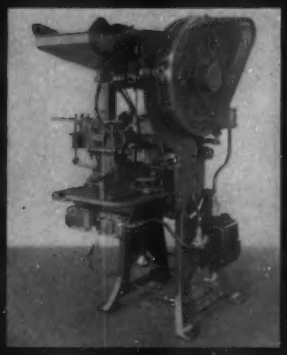
PRECISION PRODUCTION TOOLING FOR OVER FIFTY YEARS



V & O has the sturdiness that makes automation practical.



V & O can provide the working height that automation may need.



V & O has the precision that is fundamental to automation.

If made on a standardized assembly line, the mere changing of a few bolt sizes can cause a press to become a "special job." But if made in the V & O shop the most extraordinary of press automation features are just part of the day's work.

V & O was started, 65 years ago, to eliminate the problems of automated press tooling. Our long slide principle, the greatest boon to press automation, was built into the first press we ever made. We have lived with automation, worked with automation, dreamed out the answers to automation problems, for all those years. And there is no such thing as an automated press that does not have special features.

When you have a production problem that can be solved by automated tooling, automated feeds, higher precision tool motions, or tools whose lives depend upon the precision with which the press operates, take it up with V & O.

When you want the press that will be easiest for your own tool makers to automate, be sure that you get a V & O.

Our representative would like to tell you more about the press that is built like a high grade machine tool. Write us, please.

HOW SPECIAL IS A "SPECIAL" MACHINE?

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

65th Anniversary

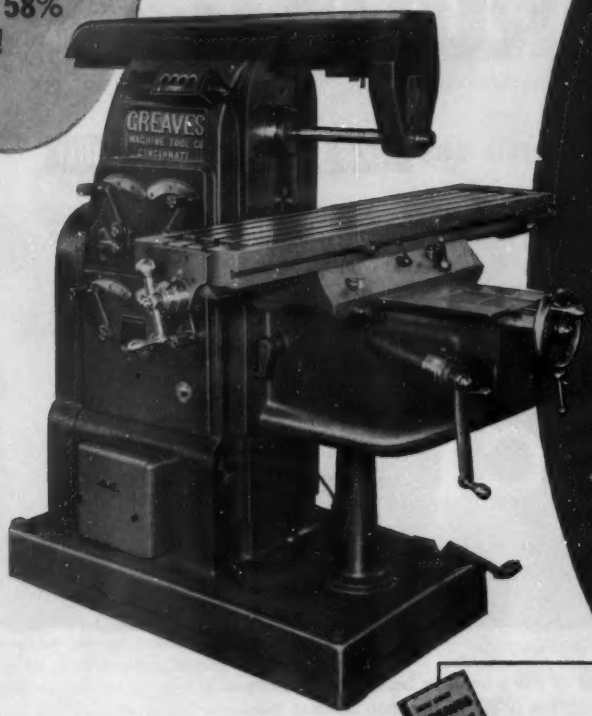
WHY THE V & O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.

GREAVES MILLS

performance and features equal to or surpassing machines costing up to 58% more!

MAKE YOUR OWN COMPARI



- Price
- Working Surface
- T-Slots number and width
- T-Slots center distance
- Swivels
- Longitudinal Power Feed
- Cross Power Feed
- Vertical Power Feed
- Spindle Center Line to Top of Table Max.
- Spindle Center Line to Top of Table Min.
- Column to Brace
- Column to Inside Arbor Support
- Arbor to Underside of Overarm
- Taper Hole Nose Diameter
- Hole Through Spindle
- Speeds Speed Range
- Feeds Feed Range
- Power Weight

Features and dimensions are easy to compare . . . and so is performance, backed up by user reports stating that Greaves 2H plain and universal milling machines outperform mills costing almost twice as much!

Before you buy any milling machine, send for your copy of the Greaves Comparison Chart. You'll find that the Greaves is full size, completely rugged, accurate and dependable . . . yet it sells for thousands of dollars less than comparable machines.

Write for your copy of this eye-opening comparison chart

GREAVES MACHINE TOOL CO.
2100 Eastern Avenue, Cincinnati 2, Ohio

Please send me the COMPARISON CHART

Name_____ Title_____

Firm_____

Address_____

City_____ Zone____ State_____

Not just an advertising slogan

Through product quality and application "know-how"

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

but a statement of FACT

FOR some months now, we've been signing all our ads this way. It expresses our 63-year-old business philosophy so well that we believe it deserves an ad of its own.

"Putting more sense in your abrasive dollar" is another way of saying that we sell superior grinding *performance*—not just grinding wheels and belts. Because your chief concern—and ours—is *how much does it cost you to do the whole job?*

Analyze *all* the factors involved: the cost of your skilled labor, the cost of running your machines and your grinding department, the cost of rejects, and the cost of the wheels or belts. Our primary function is to insure you lowest *total* grinding cost... through qualified technical abrasive engineering "know-how."

The responsibility we assume does not stop there. You will get more dependable performance on every grinding job... by CARBORUNDUM's continuous engineering development—brought to you, day in and day out, through CARBORUNDUM's nation-wide network of Industrial Distributors and Sales Offices.

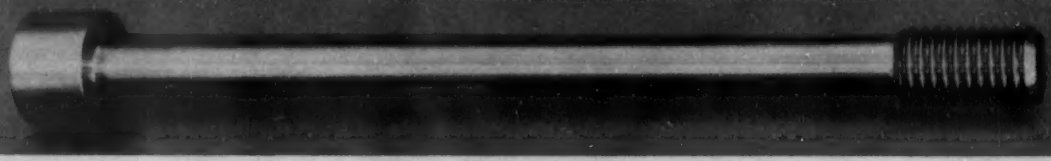
May we help you put more sense in *your* abrasive dollar?

CARBORUNDUM

REGISTERED TRADE MARK

the FIRST name in grinding

Threading that's tough...or



Threading that's fussy...

it's just another job for

Here's why so many shops standardize on the Namco VERS-O-TOOL system

- One set of ground thread chasers produces more threads than 10 sets of radial hobbed and lapped chasers.
- The Namco Vers-o-tool System (with its patented Micrometer Grinding and Checking Gauge) takes the guesswork out of chaser grinding, for chasers are ground on their holding blocks so that when replaced in the head they will cut identical threads—without making trial cuts—without adjustments—without time or scrap loss.
- **Standard stockable NC and NF Chasers, also National Taper Pipe and Dry Seal carried in stock.**

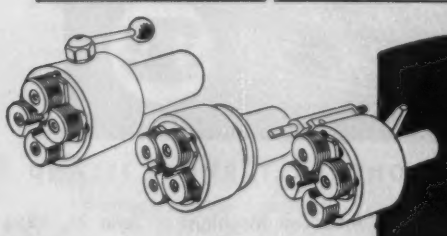
VERS-O-TOOL

These are all Class 3 threaded parts from 347 stainless steel—special threads having rounded tops and bottoms and with 32 micro finish specified.

No every day jobs to handle, these pieces, because the work-hardening tendencies of the material under cutting pressures call for the right tools and special caution to maintain the class and finish demanded.

Plenty of shops experimented with various methods of thread chasing and grinding but it remained for Screw Products Company in Cleveland to lick the job. They are using standard Vers-o-tools for diameters to 1" with standard ground thread circular chasers and are "having no trouble at all".

Doesn't this suggest your inquiry on threading work, either tough and fussy jobs or run of mine? Catalog DT-52 will help.



The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS

1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

GRIND TO .0001" OR LESS

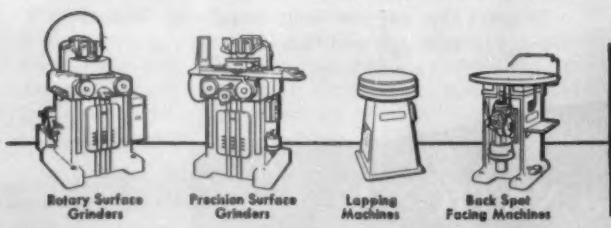
. . . and do it easily with a Taft-Peirce No. 1 Surface Grinder

This Taft-Peirce No. 1 Surface Grinder produces surfaces of an accuracy, flatness, and finish formerly considered difficult or impossible to achieve. An experienced operator frequently can grind to .00005" . . . with surfaces so smooth, in many cases, they seal without lapping.

Table, saddle, and column travel on ball bearings retained in vees of hardened and ground alloy steel. As a result, there is practically no wear on ways and moving parts. Grinding time is sharply reduced.

Control of feeds is smooth and precise. You can repeat wheel positioning true to dial setting without fear of gouging the work. Vernier fine-feed attachments are available, for either the horizontal or vertical feed, for direct readings of .0001".

Another feature — a tilting wheelhead, as shown above, simplifies setups, speeds difficult angle and shoulder work. Compact, yet heavier than other machines, the No. 1 Grinder maintains its accuracy over many years of rugged service. For more details on this and other Taft-Peirce items, write for handbook.



T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

Master Machinist's DREAM COME TRUE!

First and only truly dual-purpose lathe, with features never offered together before...the Monarch 13″ model EE precision lathe

It's a toolmaker's lathe—and it sets new standards in high work output. It's a manufacturing lathe—slashing turning time with toolroom accuracy and finish. It will do any turning job within its capacity better and faster, as a look at the partial list of features will assure you. It offers flexibility unlimited with *complete* control concentrated at the apron—66 thread and feed changes—full accessory complement as regular equipment. It's built for the utmost in ruggedness, ease, accuracy and speed. Write for our Booklet #502 with the complete 13″ Model EE Lathe story.

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Monarch makes a 10″ Model EE, too. Turn the page for details.

You Get All This in the Monarch 13″ Model EE

1. Built-in constant surface cutting speed. Most efficient cutting speed, always—improves accuracy and finish—reduces some facing times up to 50%.

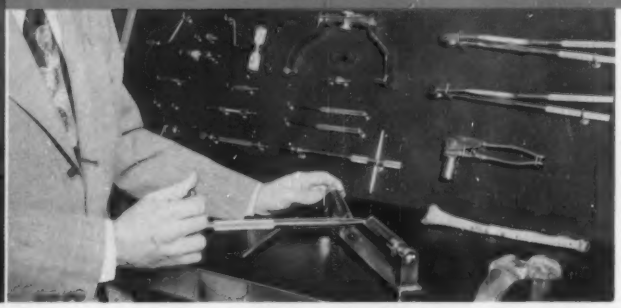
2. Infinitely variable speeds up to 2000 R.P.M. With 15 H.P. variable speed motor delivering 4 overlapping ranges, number of speeds is limitless. High speed range direct to spindle thru multiple "V" belts.

3. Electric speed change. Practically instantaneous. Accomplished from operator's normal position at apron. No calculating of lever settings by reference to an index plate is needed.

4. Four-way rapid tool traverse. Cross and longitudinal movements are provided by individual motor drive. Cuts tool adjust time 50%.

5. Unique hydraulic tailstock. Hydraulic positioning and clamping at the touch of a button. Hydraulic feed and traverse to spindle. Easiest drilling and reaming you ever saw!

Just What the Doctor Orders!



Example of sensitivity and precision without equal... from the Monarch 10″ model EE toolmaker's lathe

Doctors' orders are especially exact when it comes to these delicate but powerful, precision bone surgery instruments. To satisfy them, you need the finest machining equipment on the market.

Above you see a turning operation in the shop of Dallas R. Trinkle and Sons, famed orthopaedic engineers *and* master machinists. The part being turned by Perry Trinkle is, of course, of surgical steel. The machine is our 10″ Model EE Sensitive Precision Toolmaker's Lathe—a machine on which the Trinkles rely exclusively, because of its deft exactness in turning, boring and facing; its unlimited versatility; and because it has already given them over 40,000 hours of dependable, trouble-free service.

Perhaps your turning requirements aren't this refined. Still—wouldn't this kind of accuracy, speed and sensitivity help your production too? Let us send you our Booklet #302 giving complete information about our 10″ Model EE. Just write...

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Turn to preceding page for report on the companion 13″ Model EE Precision Lathe.

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

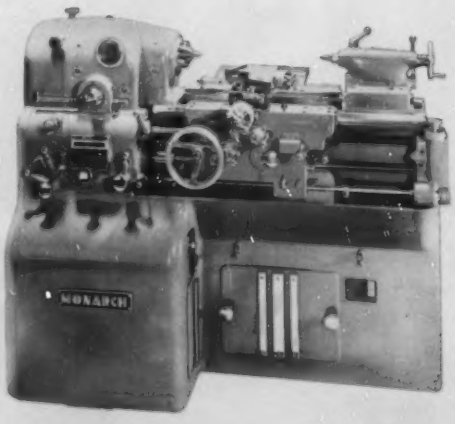
FOR A GOOD TURN FASTER—TURN TO MONARCH

Monarch 10″ Model EE features

A true high speed lathe for small work. Available with speed ranges up to 40 to 4000 R.P.M.

All electric drive direct to spindle through multiple "V" belts. No gears in headstock.

For thread chasing up to 100% faster, has exclusive combination of electric lead-screw reverse and variable reverse speed control.



The only small lathe available with anti-friction bearing taper attachment.

Easy, fatigue-free operation. Base design lets operator work close in comfort. He gets production—not backaches.

Totally enclosed, automatically lubricated end gearing and gear box.

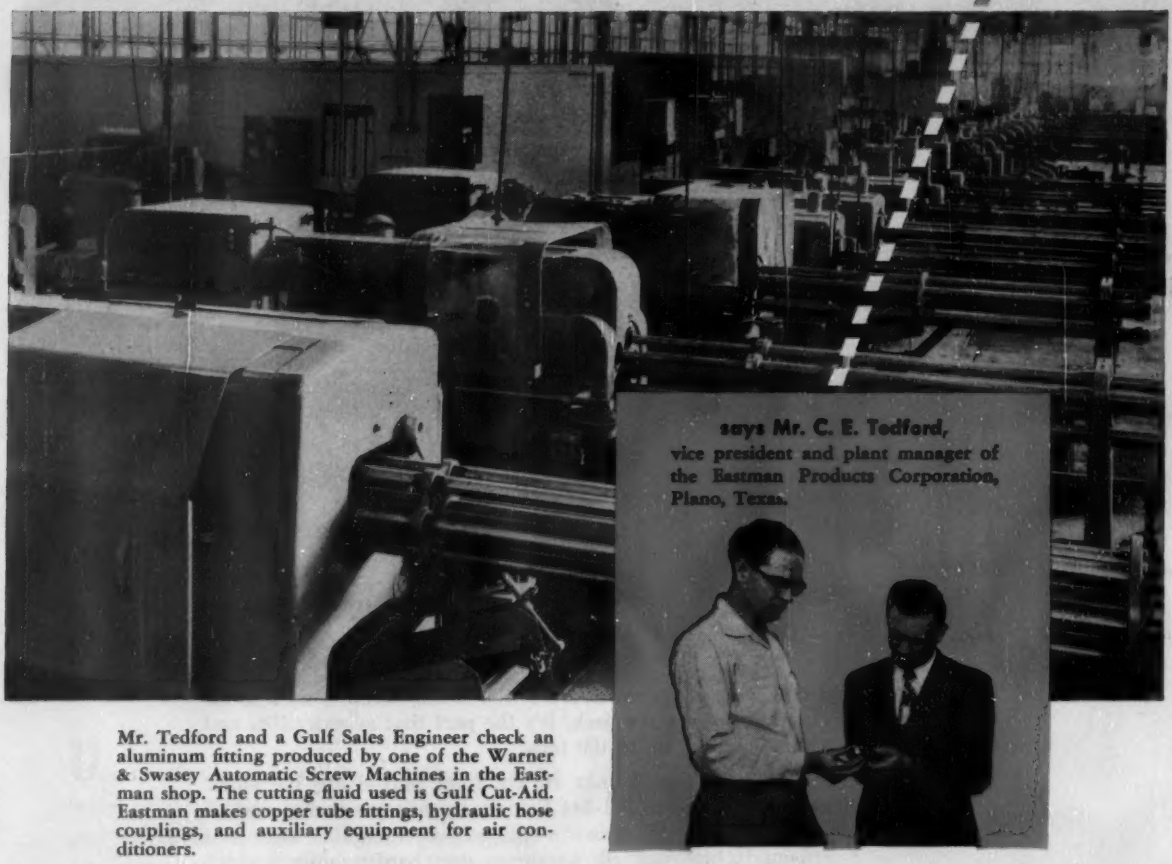
Flame hardened and ground ways for both carriage and tailstock. Bed all in one piece—no inserts.

American Standard Camlock spindle nose—3″ Type D-1.

Over 6000 10″ Model EE machines in use today.

The 10″ Model EE—sensitive and exact as a great surgeon's hands—versatile as the venerable country doctor. Manufacturing and Toolmaker's models. With Monarch Air-Gage Tracer, they become high-output production machines noted for speed, accuracy and high finish.

"TOOL LIFE UP 400%
PRODUCTION UP 50%
WITH GULF CUT-AID"



says Mr. C. E. Tedford,
vice president and plant manager of the Eastman Products Corporation, Plano, Texas.

Mr. Tedford and a Gulf Sales Engineer check an aluminum fitting produced by one of the Warner & Swasey Automatic Screw Machines in the Eastman shop. The cutting fluid used is Gulf Cut-Aid. Eastman makes copper tube fittings, hydraulic hose couplings, and auxiliary equipment for air conditioners.

A cutting fluid has to be outstanding to increase tool life 400% and production 50%—and that's what Gulf Cut-Aid has accomplished at Eastman Products! You too will discover that Gulf Cut-Aid, when used for machining aluminum, magnesium, and many other nonferrous metals, consistently produces better results—that means lower costs for you.

Here are some of the advantages of Gulf Cut-Aid that make such results possible: high rate of penetration, "wettability," and excellent cooling properties. It quickly covers tool surfaces to provide constant protection. It also contains an effective anti-oxidation additive which helps prevent gum and sludge formation in the coolant system. And it will not corrode or stain metals.

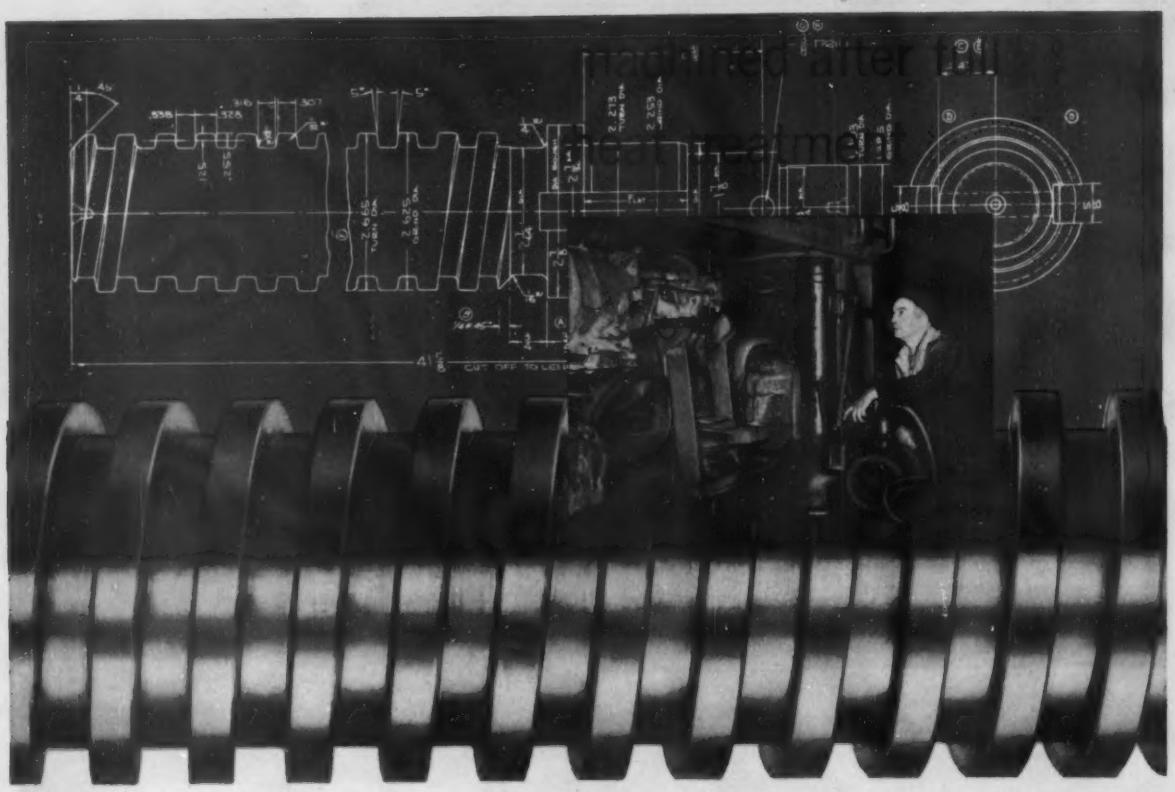
Let a Gulf Sales Engineer assist you in finding opportunities for improved machining practice in your plant through the use of Gulf Cut-Aid. Contact him at your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF SERVES INDUSTRY

MAX-EL alloy steel part for 100-ton jack



The Max-el part shown above is the lifting screw from a Duff-Norton air motor screw jack. It's the part that actually lifts and holds the load . . . up to 100 tons.

To make the part, blanks are cut from Max-el 3½ bar stock. After heat treating to 321-341 Brinell, threads are chased and all machining performed. Max-el's optimum machinability after heat treatment, its high-strength, toughness, deep hardenability — which prevents thread sinkage, and high surface finish make it an ideal choice for this rugged application.

But try Max-el yourself. Its excellent machinability means longer tool life, more pieces per grind. And you'll appreciate its freedom from distortion and superior quality. For immediate delivery of Max-el call your nearest Crucible representative.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

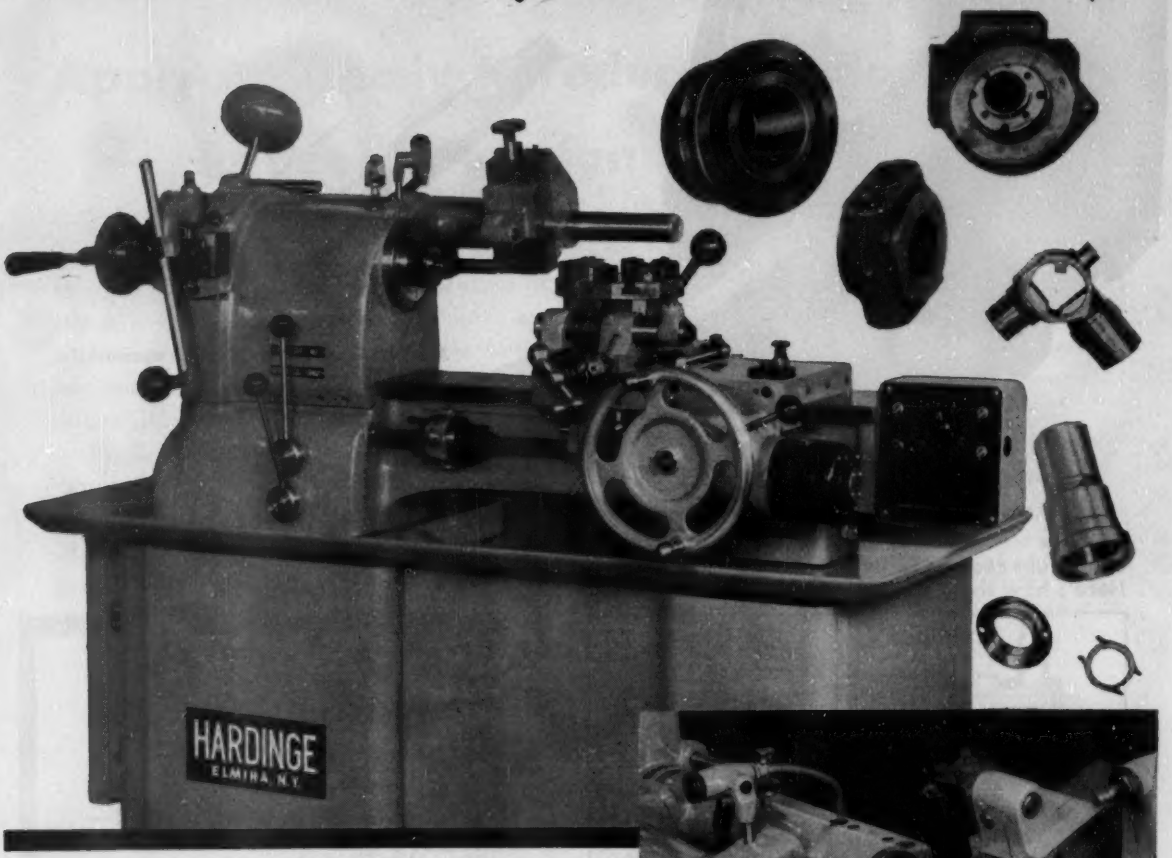
Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DAYTON DENVER • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH PROVIDENCE • ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • ST. PAUL • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

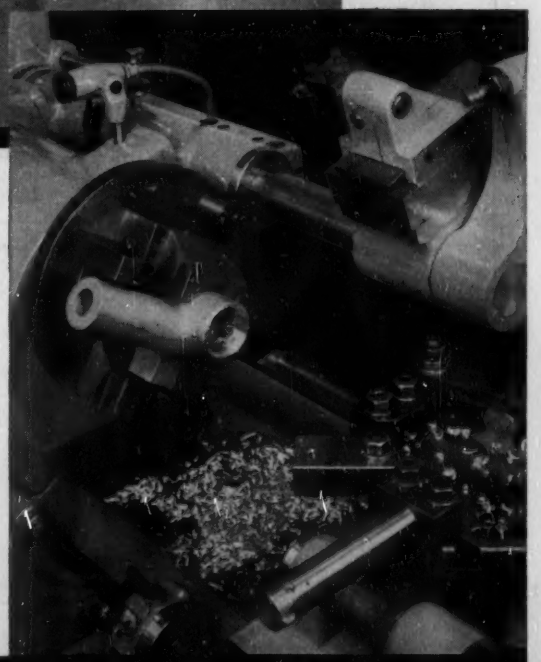
HARDINGE
ELMIRA, N.Y.

PRECISION CHUCKING MACHINE

Users say:

"We now get Production with Tool Room Accuracy"





Users enthusiastically tell us how they can easily maintain close tolerances, get better parts finish, and at the same time substantially cut costs . . . when they put Hardinge High Speed Precision Chucking Machines to work.

These results are possible because parts are finished in one setting with simplified tooling. All parts shown were produced with standard tool bits.

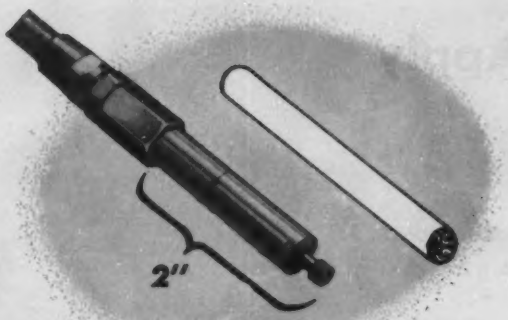
1" Collet Capacity—6" Chucking Capacity—Write today for Bulletin HC-HCT which presents the whole story.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

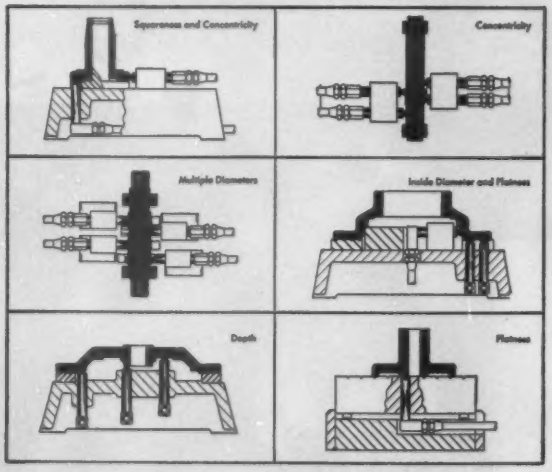
FEDERAL



AIRPROBE is smaller than a regular cigarette!

You Don't Need Any Masters to Calibrate the AIRPROBE

Some Jobs require Federal Special-Design Gages. Here's how the AIRPROBE is applied:



Federal's Model 165 Hole Gage equipped with a Federal AirProbe. Gage makes mechanical contact with the hole diameter.

4 EXCEPTIONAL FEATURES:

❶ self-zeroing

No tolerance setting masters required — simply set the AirProbe to zero on the Dimensionair scale and adjust in the gage as you would a Dial Indicator.

❷ accurately calibrated

All readings on the dial are actual calibrated readings — not arbitrary values divided between minimum and maximum limits as with other air gages.

❸ longer measuring range

A much longer range per magnification than that of other similar gage heads. Available ranges, with different dials, are .003", .006", .015", and .030".

❹ longer approach range and overtravel.

With an approach travel of .031", a spindle travel of .140", and an overtravel of from .070" to .100", there's plenty of surplus for easy setting and measuring.

AIRPROBE !

Apply it directly to Federal Catalog Gages — No need to design Special Gages!!

The Federal AIRPROBE now makes it possible to gage by air a great variety of dimensions of almost any type, under almost any condition, when circumstances indicate that air can do the job best. It's a universal gage-head — a small, spindle-like device — which can be used in practically the same manner as a Dial Indicator on gaging fixtures, otherwise inaccessible locations, and on machine dimension control applications. Dimensional variations are read directly on the precisely calibrated dial of the Federal Dimensionair just as they are on a Dial Indicator.

Any production supervisor, engineer, or inspector, realizes that top efficiency lies in careful selection of the gage best suited to the requirements. Gaging with the DIMENSIONAIR AIRPROBE often offers certain advantages and enables him to meet his requirements with a greater degree of precision.

Federal offers practically all systems of gaging — air, dial indicators, electrical, and electronic. We design and make all these gages and can advise you *without bias* as to what system is best suited to your requirements. Ask our engineers for their recommendations. Federal Products Corporation, 4126 Eddy Street, Providence 1, R. I.

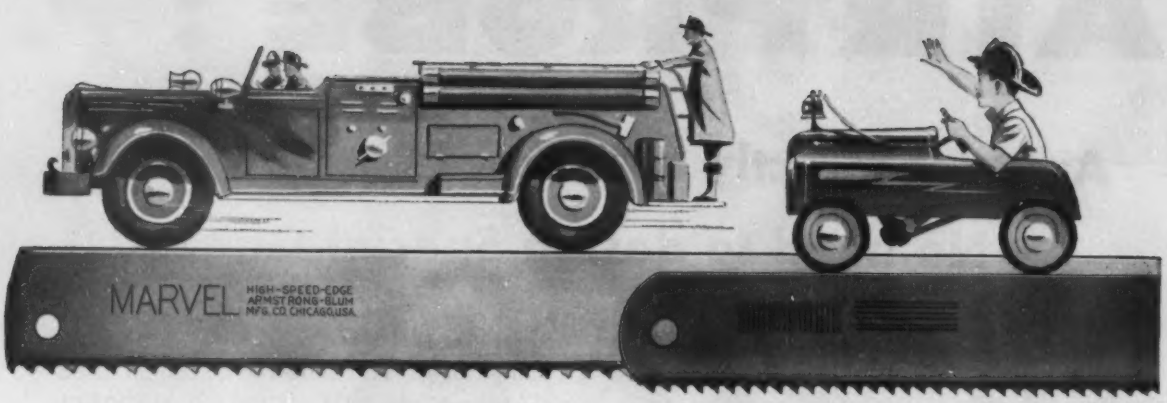
Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES...

DIAL INDICATING, AIR, ELECTRIC OR ELECTRONIC — FOR INSPECTING, MEASURING, SORTING OR MACHINE SIZE CONTROL

A regular Federal Catalog Gage, Model 36 B-6 Bench Hole Gage, equipped with a Federal AirProbe and Dimensionair. Don't waste time designing special gages to use air when Federal already has *Catalog Gages* of proved designs.

The well known Federal NB-60 is shown here with a Federal AirProbe and Dimensionair. Another illustration of the economy of using Federal "already designed and built" gages with air.



. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* SAWS

Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

repetitive accuracy
high speed production
and fine finishes

...with push button control!

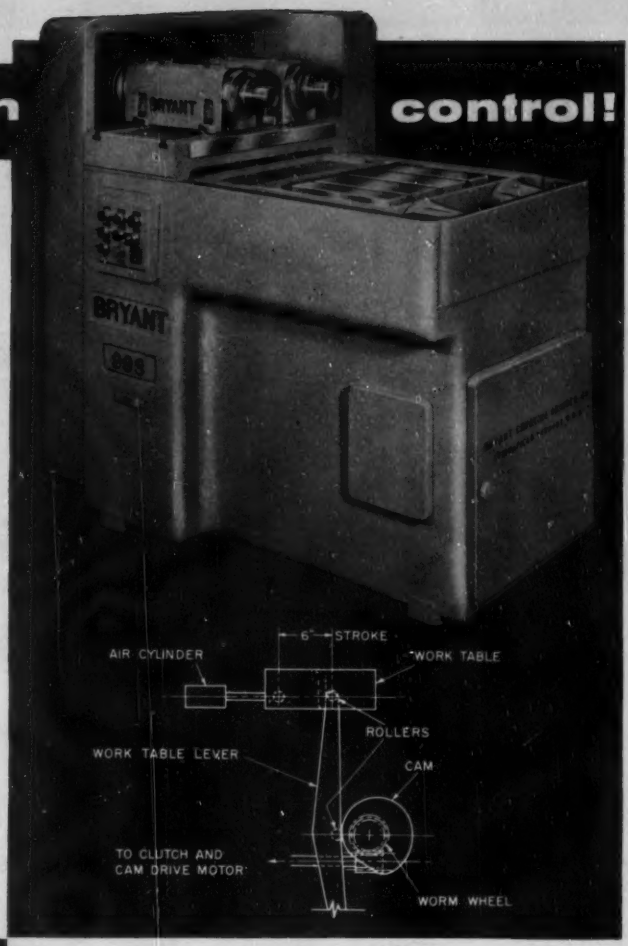
BRYANT 6" STROKE *all Mechanical* BORING MACHINE

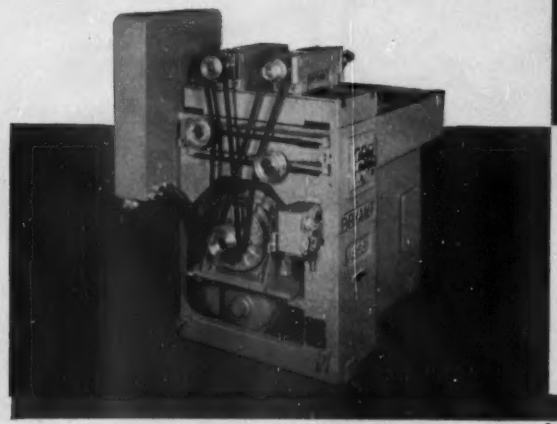
This new Bryant 998 Boring Machine gives you fine finish and rapid production in precision boring, drilling, turning, facing, grooving, and contour turning and boring.

The cycle can be fully automatic and controlled with a single push button, or the operator can control any phase of the cycle manually.

To assure highest repetitive accuracy, the constant feed table on this boring machine is mechanically actuated by a cam and lever.

The wide bridge can accommodate as many as four boring heads of the smallest (209) bearing size. The 5 HP boring head motor provides ample power for driving the heads. Both the cam drive and the boring head motors are mounted in a well ventilated cavity in the bed.





SPECIFICATIONS

Total table stroke	6"
Top of table to top of bridge	4"
Width of bridge	27⅜"
Multiple boring heads as required by tooling to a maximum of 4 (209)heads	
Table dimensions	17½" x 22"
Floor space (without coolant tank)	31" x 54"

Mail coupon for complete details!

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT

Gentlemen: Please send me your Bulletin 998. AM

Name.....

Title.....

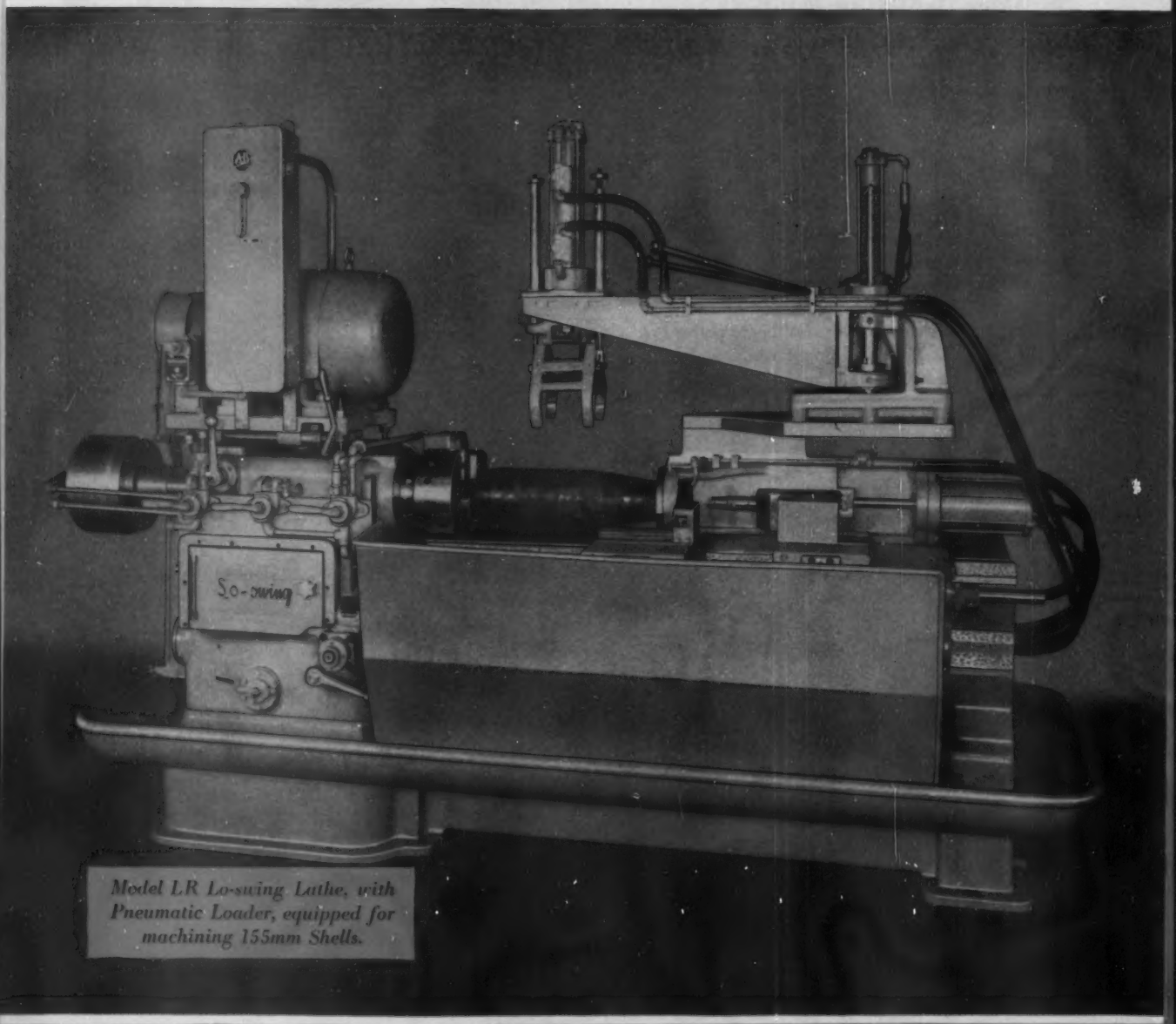
Company.....

Street.....

City.....Zone.....State.....

MACHINE OF

MODEL "LR" *Lo-swing* LATHE, BORES, FACES AND CHAMFERS OPEN END OF 155mm SHELL AT LOW COST

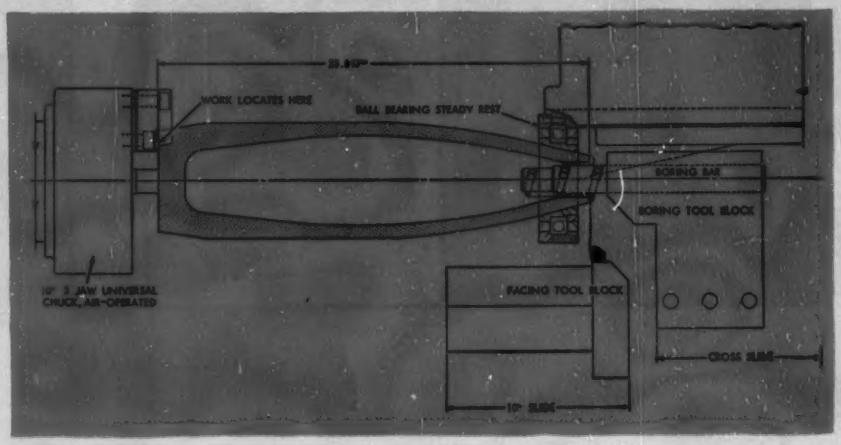


Model LR Lo-swing Lathe, with Pneumatic Loader, equipped for machining 155mm Shells.

PRODUCTION COSTS

THE MONTH

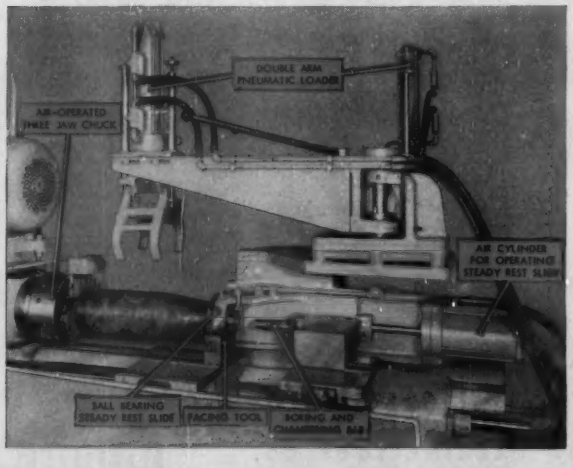
PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



PROBLEM: To rough and finish bore, face and chamfer thread diameter of 155 mm shells automatically.

SOLUTION: The Model LR Automatic Lo-swing Lathe selected for this job was equipped with a pneumatically-operated, three-jaw chuck for holding and driving the shells from the boat tail end. The opposite end is supported with a cone-shaped, ball-bearing rest mounted in a special heavy duty fixture which replaces the standard tailstock. The revolving rest is built into a sliding member which is operated by a large air cylinder, controlled by a hand valve. The construction of the revolving rest is shown in the line illustration.

The lathe is equipped with two independently-operated front slides. The left hand slide carries a tool block and tool for facing the open end of the shell to length and has a cross feed movement only. The right hand slide carries the combination rough and finish boring tools as well as the chamfer tool. This slide has both longitudinal and cross feed movements, providing tool relief on the return stroke of the boring bar. All tools operate simultaneously on a very fast machine cycle.


DOUBLE ARM PNEUMATIC LOADER
AIR-OPERATED THREE JAW CHUCK
AIR CYLINDER FOR OPERATING STEADY REST SLIDE
BALL BEARING STEADY REST SLIDE
FACING TOOL
BORING AND CHAMFERING BAR

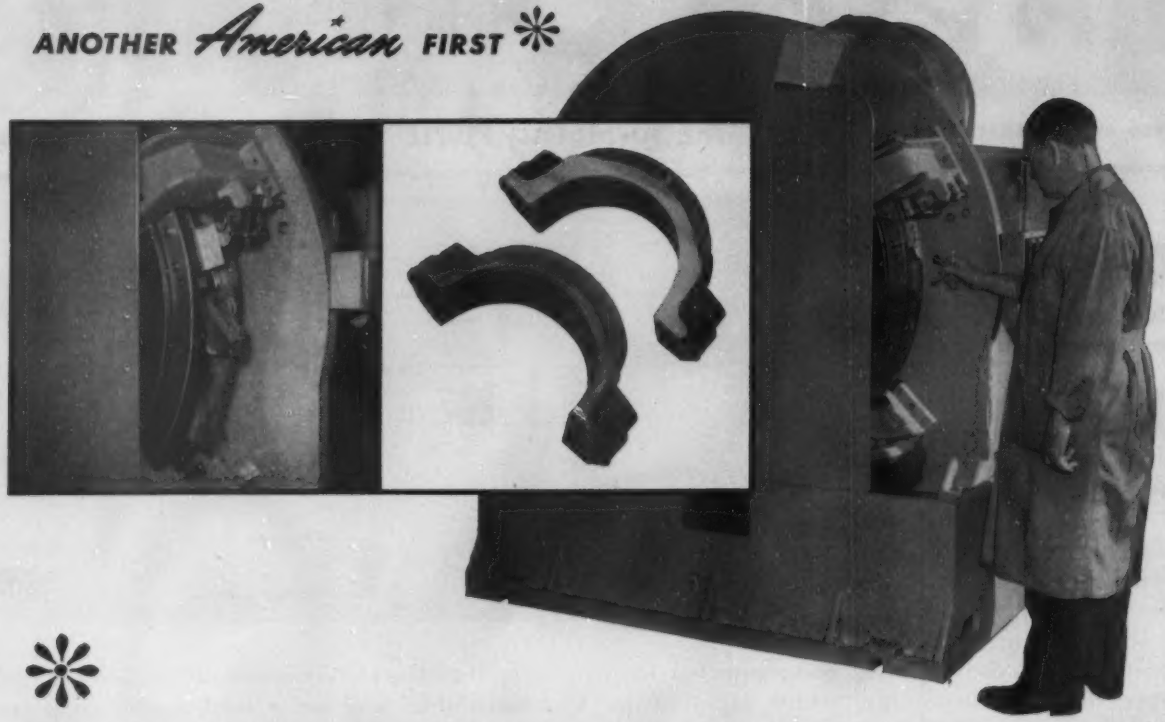
The problem of loading and unloading the heavy shells was solved with a double-arm, pneumatically-operated loader. A conveyor delivers rough shells to the rear of the machine. In position No. 1, one arm of the loader is directly above this conveyor and when lowered, picks up a rough shell while the other arm is clamped around the finished shell held between centers. The operator then moves a control lever which retracts the revolving rest and also opens the chuck jaws. The shell is pushed clear of the chuck jaws by means of a spring loaded plunger located in the headstock spindle. The operator now moves another control valve, which raises the loading device and swings it through 90 degrees to No. 2 position. This movement delivers the rough shell between centers and the finished shell to a second conveyor, located at the front of the machine, which leads to the next operation.

Seneca Falls engineers are at your disposal to help solve your turning and handling problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH Lo-swing

ANOTHER *American* FIRST ✻



STRADDLE BROACHING ON ROTARY MACHINE MEETS HIGH-SPEED PRODUCTION DEMANDS

1000 connecting rod caps broached per hour —

Continuous, automatic broaching is a necessity on some high production jobs. When required and the nature of the work permits, American engineers develop special, revolutionary machines to solve bottlenecks and reduce metal removal costs to the lowest possible point.

A typical example is this special 36" Rotary Continuous Surface Broaching Machine. It is designed to straddle broach two sides of a connecting rod cap. The production cycle is continuous. The operator manually loads parts into the holding fixture. As the part moves into broaching position it is automatically clamped, broached, unclamped, and ejected into the chute at the bottom of the machine. Operating at 75% efficiency, this American machine is capable of producing 1000 parts per hour. The connecting rod cap is a steel forging.

For practical, high production, low cost solutions to your metal cutting problems see American first. A sample part or detail drawing and mention of your production requirements will receive prompt attention from American.

Write today for American Circular 300 which gives you data on standard American Vertical Hydraulic Surface Broaching Machines.

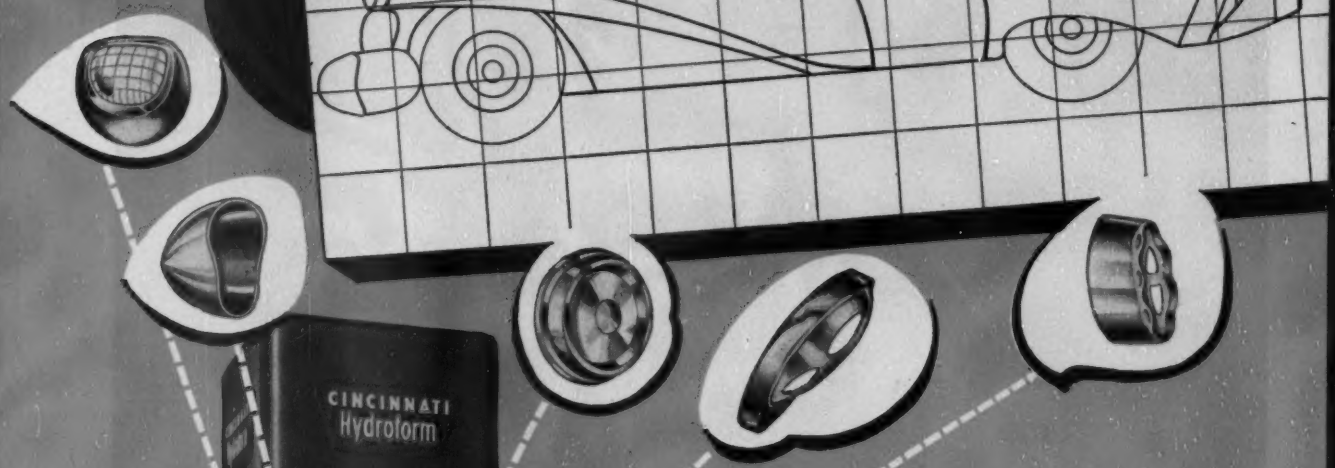
AMERICAN *American* BROACH & MACHINE CO.
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

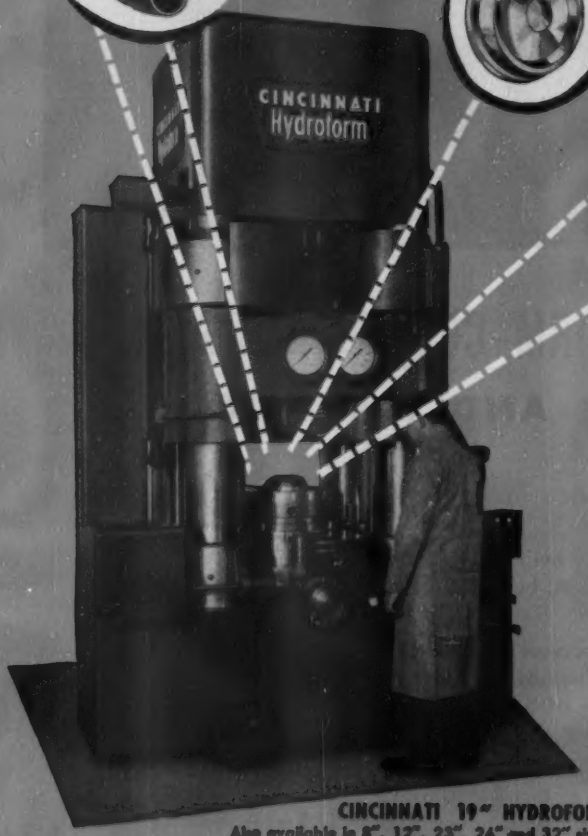
SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

make realistic savings in "dream car" construction by

Hydroforming





CINCINNATI 19" HYDROFORM
Also available in 8", 12", 23", 24" and 32" sizes.

Hydroforming is an economical method for producing prototype or short-run components.

Simple to tool, Hydroforming makes possible lower per-unit costs than can be obtained by other methods. Tools are often made overnight. Modifications can be made incurring minimum additional tool expense. Complex shapes are produced in a single draw, as the percentage of reduction in the draw is far greater than conventional practice. Relatively few shapes require more than two forming operations. Different gages of different materials can be tried out using the same tools.

Let a Cincinnati Milling field engineer show you how the cost- and time-saving advantages of Hydroforming can be profitably applied to your work. For a description of the Hydroforming process and specifications of the six machine sizes, write for Bulletin M-1759-3.

CINCINNATI Hydroform

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

BARBER-COLMAN FORM CUTTER DESIGN

LESSENS CHATTER AND VIBRATION

Helical Teeth Provide Continuous Cutting Action

Shearing action of these Barber-Colman helical-fluted form cutters not only reduces chatter and vibration to a minimum, but also improves tool life and production on this milling job.

Gang-type cutters are recommended because they combine several operations in a single cut, and also because individual sections are interchangeable for other gang operations. Due to the type of cut and non-uniform material, some sections receive more wear than others and require more frequent replacement. With the gang arrangement, section replacements can be ordered singly, thereby reducing tooling costs.

Redesign of the cutters for this job included the adoption of helical teeth recommended by Barber-Colman Engineers. These helical teeth provide continuous cutting action and have eliminated chatter in the cut.

GOOD TOOL LIFE IN NON-UNIFORM MATERIAL

These cylinder liners are milled on two surfaces, 180° apart, using a feed of ¾″ per minute and cutter speed of 123 RPM. Cutters are 4½″ diameter x 5.477″ overall length, with helical teeth, and are fed radially to depth. The cast-steel liners are non-uniform in structure, and frequent hard spots are encountered. Production is 5 sleeves per hour compared with 2 per hour obtained with former straight-fluted cutters. Tool life averages 35-50 pieces per sharpening, depending upon the consistency of the material. There is no evidence of chatter or rapid wear as experienced with straight-fluted cutters.

EXTRA QUALITY AT NO EXTRA COST

Barber-Colman form-relieved cutters are checked within close tolerances for true concentricity and accurate index throughout each manufacturing step. This quality control requires extra operations and closer manufacturing inspection. No extra charge is made for this accuracy since Barber-Colman Engineers want to be sure that the proper degree of accuracy is present in all form cutters.

As a result of this accuracy, Barber-Colman form-relieved cutters do not require cylindrical grinding and "spot sharpening" in order to properly recondition them. They are simply and easily face-sharpened on any sharpening machine having controlled indexing. Consequently, they have low maintenance costs.

We would like to show you the superior cutting performance of this type of accuracy on your next production milling operation. Send us prints or samples for analysis and estimate on any form-relieved cutter application.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

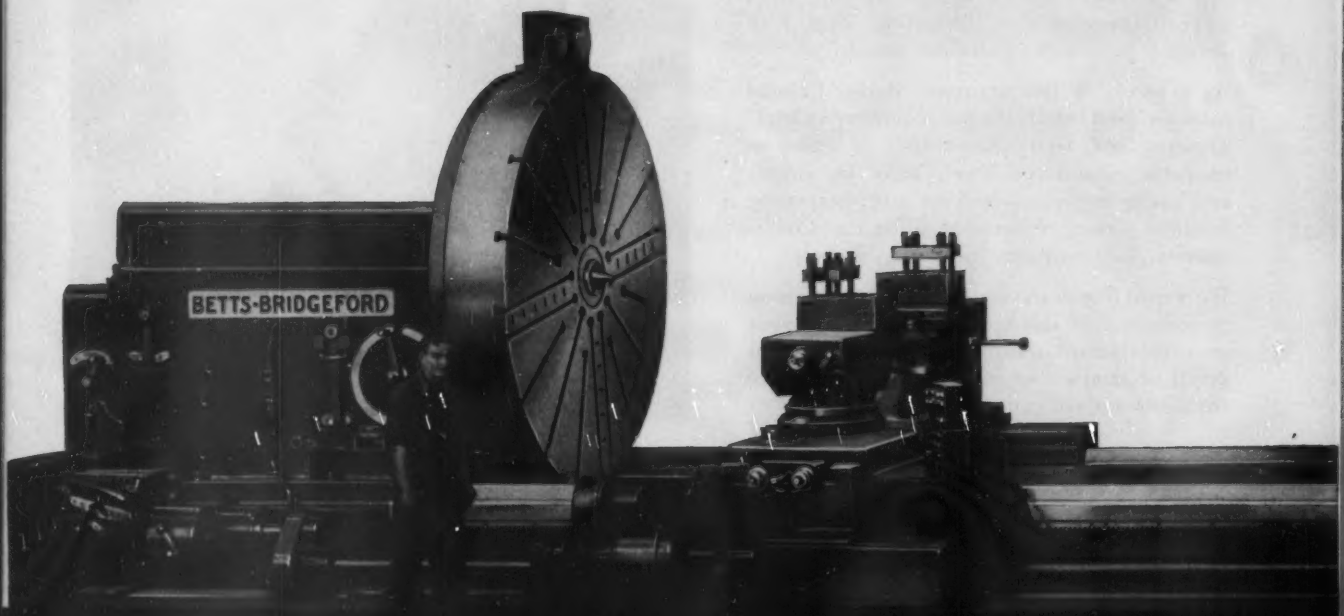
Barber-Colman Company

GENERAL OFFICES AND PLANT, 616 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

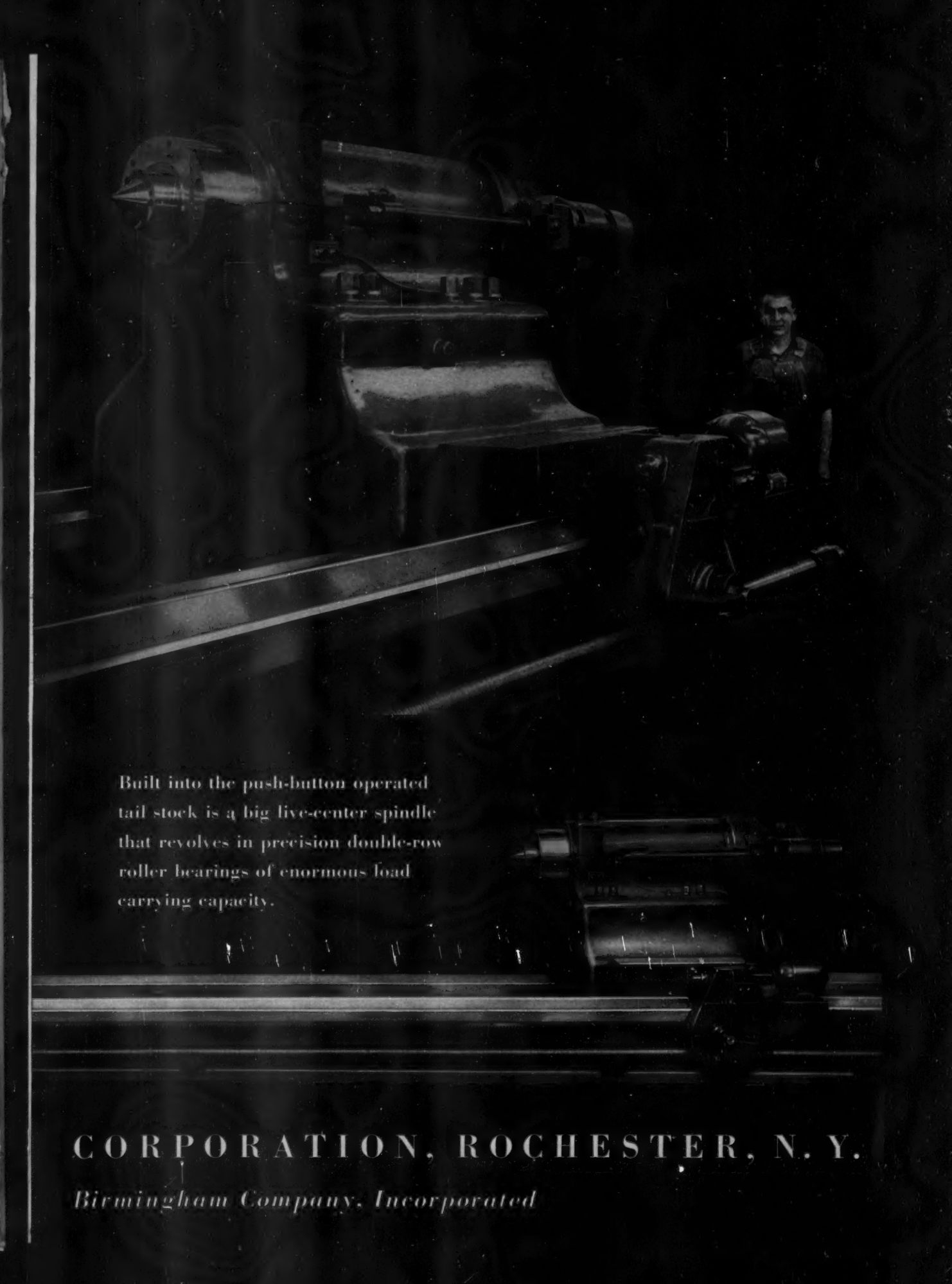
Another Big One!

A 96 Inch Heavy-Duty Betts-Bridgeford Lathe for the precision turning of forged steel steam turbine shafts weighing up to 90 tons!



CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-



Built into the push-button operated tail stock is a big live-center spindle that revolves in precision double-row roller bearings of enormous load carrying capacity.

CORPORATION, ROCHESTER, N. Y.

Birmingham Company, Incorporated

WHY IT PAYS TO BUY MECHANICAL TUBING FROM US

You can reduce storage space, increase productive area

● There's no need of sacrificing large areas of valuable floor space for tubing storage when those areas *could* easily be made productive. Why not let *us* carry the storage and handling costs?

Our warehouses stock an exceptionally large variety of tubing products . . . in fact, no less than 531 sizes of Shelby Seamless Mechanical Tubing are readily available! So you can always count on quick delivery of exactly the type and size tubing you need . . . whether your order is by the inch or by the carload. And all our tubing products are made by the world's leading manufacturer of fine tubing and pipe —National Tube Division of U. S. Steel.

And, our extensive experience with tubing problems has often led to customer savings. For in many cases, our engineers can suggest a more economical type of tubing for your application.

Contact our nearest warehouse the next time you need quality tubing of any sort and in any quantity from our stock or directly from the mill: mechanical tubing, round and square, seamless and welded; boiler tubing, pressure tubing and pipe; and stainless steel tubing and pipe, seamless and welded.

TRIPLE SECURITY

What you want
When you want it
At the right price

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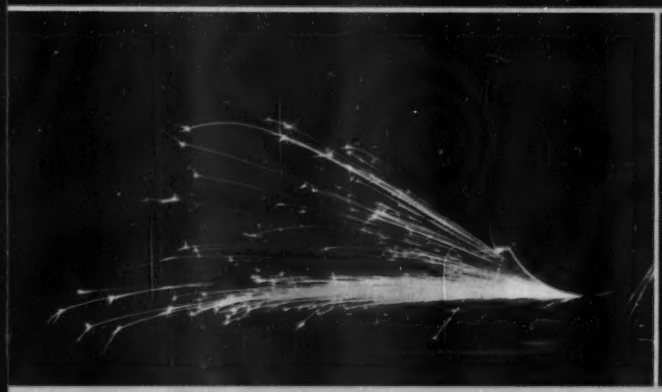
USS STEEL
UNITED STATES STEEL

UNITED STATES STEEL



Every little spark stream has a meaning all its own

Upper photo, HIGH CARBON STEEL . . . lower left, TITANIUM . . . lower right, HI-SPEED STEEL.

Touch a grinding wheel to a bar or billet, and a trained spark-tester can tell you what the metal is—even what the alloy is—by observing the spark pattern. Many companies use this method to double check the metals used in manufacture. It is one thing to choose a grinding wheel for spark testing—quite another to choose one for production grinding. The spark stream from your grinding machine tells a different story—a *profit* story—when you use grinding wheels by CARBORUNDUM. Profitable grinding is possible only with the wheel that suits your production demands, your machine, your operator. Making *sure* you get the right wheel for every purpose is a cardinal rule at CARBORUNDUM. For proof, call your Distributor or Salesman today.

Through application "know-how" and product quality

CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar

Hind-side as sandy as fore-side

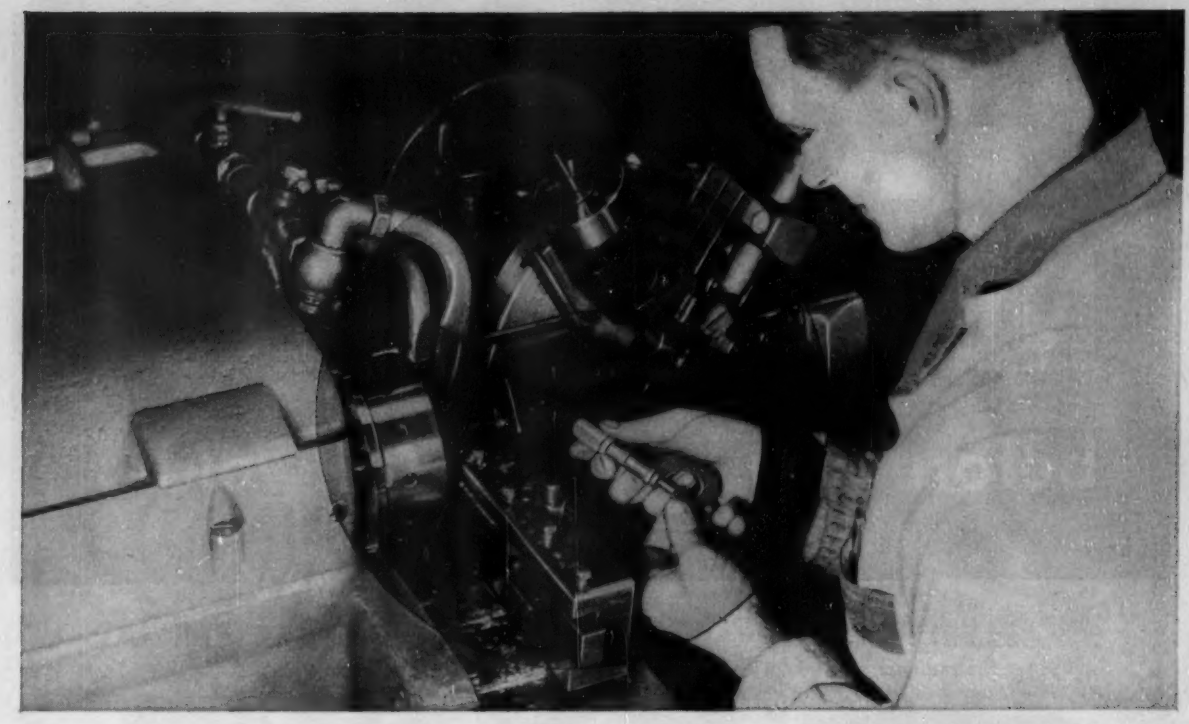
Use *both* sides of SAND SCREEN for sanding and finishing...do from 7 to 15 times more work with one sheet or disc than you can with conventional coated abrasives. Removed material flows through the open mesh—you sand faster, longer, with much less loading. Use SAND SCREEN wet or dry...for hand or machine finishing. Fold it—tear it to any convenient size. CARBORUNDUM'S SAND SCREEN Discs and FASTCUT Pad 85 Assembly slash time and costs on wet sanding of prime coats. On many operations of sanding flats and slight contours, no adhesives are necessary. Cut sheets fit oscillating or vibrating sanders... do a terrific job wherever loading and glazing is a problem. Get samples today from your CARBORUNDUM Distributor or Salesman.

Through product quality and application "know-how"

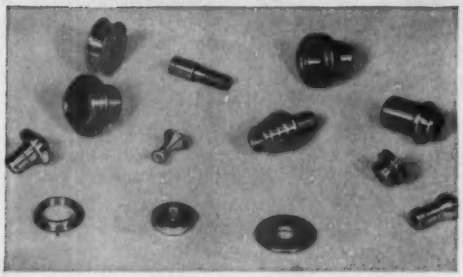
CARBORUNDUM

REGISTERED TRADE MARK

continually puts more sense in your abrasive dollar



TOOL LIFE INCREASED 40% USING CITIES SERVICE CUTTING OIL



ONE OIL FOR ALL? After poor results with many cutting oils, the Dunbar Machine & Tool Company discovered all their cutting jobs could be done to perfection using only one oil . . . Cities Service Chillo #44.

NO EYE STRAIN. In addition to a 40% increase in tool life, owner Robert Dunbar found that the transparent characteristics of Chillo #44 help eliminate eye strain. Cutting operation is easily visible to operator.

Production Also Up, Reports Dunbar Machine & Tool Co.

THE PROBLEM . . . The Dunbar Machine & Tool Company had a problem. It seemed impossible to find one oil which would perform economically and efficiently for ALL the jobs required of the firm's automatic screw machines.

THE SOLUTION . . . After trying many brands of cutting oil, "none of which gave good all-round performance," owner Robert Dunbar called in a Cities Service engineer. After careful analysis of the problem, the engineer recommended Chillo #44 cutting oil.

THE RESULTS . . . Using Chillo #44, the company observed these results: Tool life increased nearly 40% . . . Production increased accordingly . . . Additional savings realized due to chip draining characteristics of oil . . . Holding tolerances no longer any problem . . . Machine clean-up time now insignificant . . . Transparency of oil eliminates eye-strain . . . Less smoke and fumes at high speeds . . . Also excellent for lubricating purposes. Says Mr. Dunbar, "Our results with Chillo #44 permit us to heartily endorse this product."

If you have a cutting oil problem, consult your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CHECK LINCOLN'S NEW LOW PRICES

before you buy any AC welder

FLEETWELDER

... prices reduced 11% to 24%

Fleetwelder AC *with Arc-Booster. 300, 400, 500 amp sizes. For wide range of light and heavy welding with AC.*

Fleetwelder Special. *300, 400, 500 amp sizes. More useable amps* per dollar *than any AC welder.*

FLEETWELDER SPECIAL

... new *low-priced* AC welder

LOWEST COST AC WELDING

Lincoln's new combination of lower AC machine prices and faster welding with Jetweld heralds another development in Lincoln's program to lower welding costs.

The highest manual AC welding speeds ever attained are now available to industry . . . and at lowest possible cost because:

1. Lincoln AC machine prices are lowered 11% to 24% . . . *and more with the new Fleetwelder Special.*

2. 35% and higher welding speeds can now be realized with Jetwelding . . . using the cost-cutting combination of Jetweld and Lincoln AC power.

WRITE FOR PRICES

— Benefit Now. Have your Lincoln representative check your requirements for both electrodes and welders. Call or write.

THE LINCOLN ELECTRIC COMPANY

DEPT. 2004 • CLEVELAND 17, OHIO

THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

Time to Reduce Milling Costs!

COSTS DOWN!
PRODUCTION UP!
No. 1-8
8" table travel... 25" x 9" table... automatic hydraulic table feed.
No. 2-20DS
Double Spindle for two milling operations at same time... 20" table travel ... 42" x 12" table.
No. 2-20
20" table travel... 42" x 12" table.. fully automatic hydraulic table feed.
No. 1-14DS
Double Spindle for two milling operations at same time ... 14" table travel ... 32" x 9" table.
No. 1-14
32" x 9" table ... 14" table travel ... hydraulic table feed ... full automatic cycle.
No. 1-V
Hydraulic vertical head feed ... 5¼" head travel ... 25" x 9" table.
No. 2-20V
20" table travel... vertical spindle with speed range 32 to 1284 R.P.M. ... 42" x 12" table.
No. 1-M
Hand feed to table and head ...25" x 9" table ... Adjustable head counterbalance.

KENT-OWENS REPRESENTATIVES

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General Machinery Corp.

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Dan W. Patterson

CHICAGO
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Kent-Owens machines assure you of speed with accuracy... and cut your milling costs! Designed with advanced features ... performance-proved for meeting tough schedules in production milling. Rugged ... simple ... versatile. Twin-post head mounting assures balanced load. Greater cutting efficiency—only two gear contacts, motor to cutter. Write for bulletins on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, Ohio.

Call on

KENT-OWENS

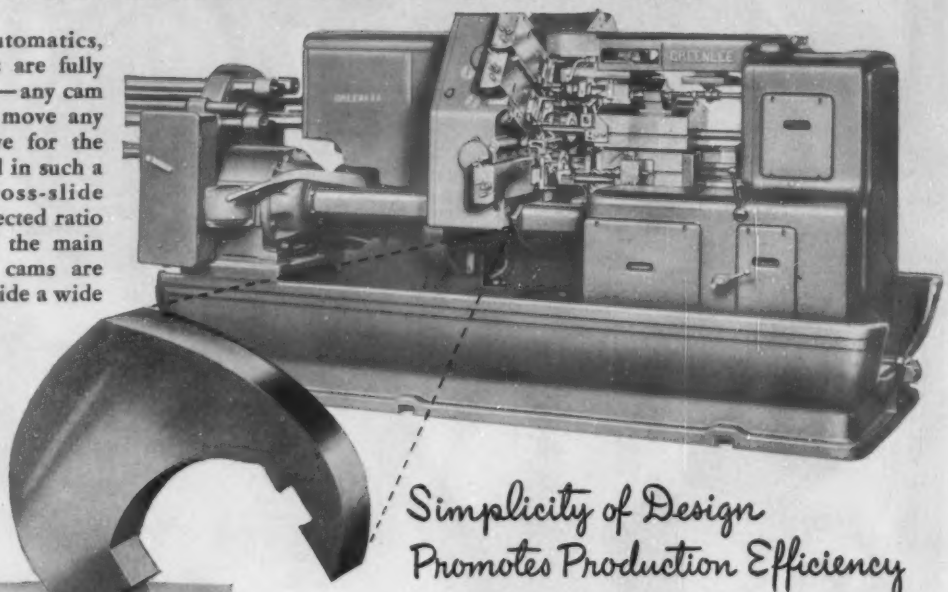
for Milling Machines

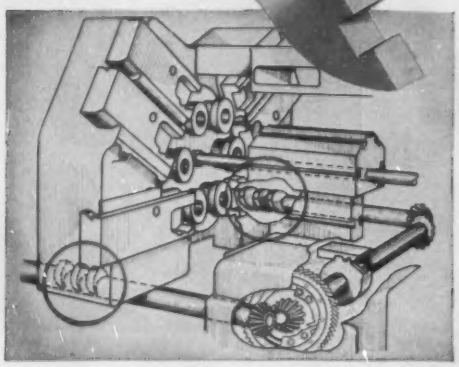
GREENLEE *Automatics*

INTERCHANGEABLE CROSS-SLIDE CAMS

On Greenlee Automatics, cross-slide cams are fully interchangeable—any cam can be used to move any cross-slide. Drive for the cams is arranged in such a way that the cross-slide travel is in a selected ratio to the travel of the main slide. Standard cams are available to provide a wide range of ratios.

In the average job shop, a set of only 15 standard cams will provide enough flexibility to take care of 90% of the jobs that will come through. Standard ratios range from 1½:1 to 8:1.



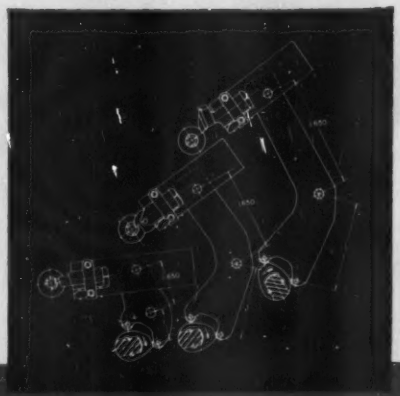


Simplicity of Design Promotes Production Efficiency

The distinctive Greenlee cross-slide cam design and operating features promote production efficiency on many short-run jobs because they reduce changeover time. In addition, there is an economy of investment.

As shown at the left, cross-slide cams are located at the sides of the machine, under the open ends of the cross-slide housings, where they are easily accessible.

As shown at the right, each cross-slide is operated independently by a separate cam, making it easier to split up operations and arrange better tooling set-ups.

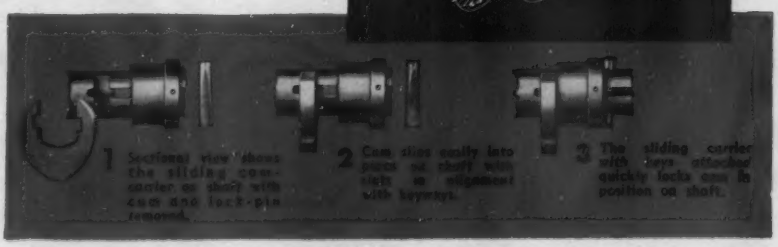


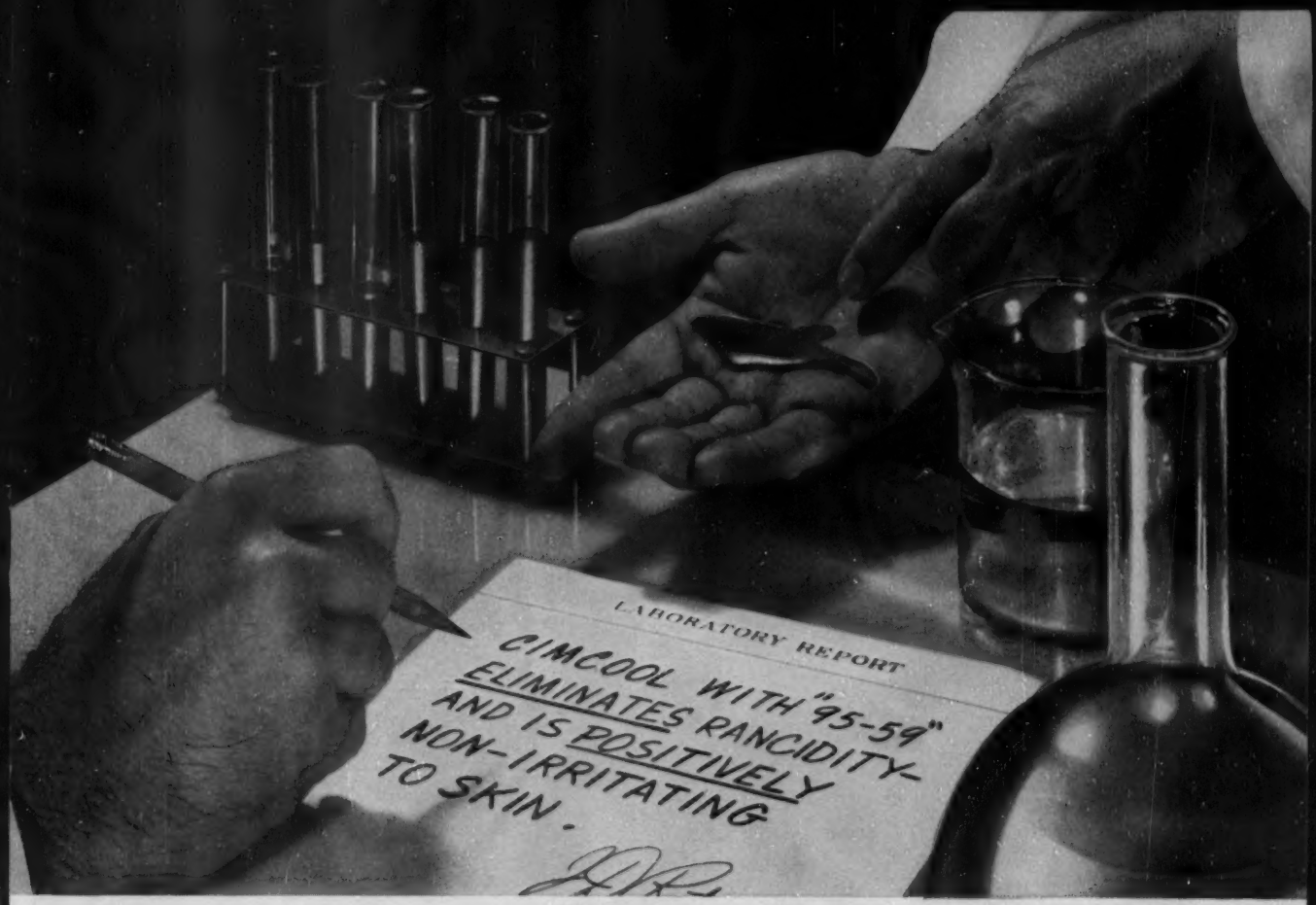
Write for FREE Literature

PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.
1726 MASON AVE., ROCKFORD, ILL.


1 Sectional view shows the sliding cam-carrier on shaft with cam and lock-pin removed.
2 Cam slips easily into place on shaft with slots in alignment with keyways.
3 The sliding carrier with cam attached quickly locks cam in position on shaft.



Important Discovery Made in Scientific Tests of CIMCOOL

Actual scientific laboratory and shop tests prove—*beyond doubt*—that CIMCOOL® with "95-59" eliminates rancidity and is positively non-irritating to the skin!

Operators say this radically new and different coolant—this *chemical emulsion*—is the biggest working improvement in years. The amazing ingredient "95-59" is a more effective bactericide, is non-corrosive and eliminates rancidity and foul odors—even in the hottest weather.

That's why plant after plant reports that CIMCOOL, in contrast with old-fashioned cutting fluids, can be kept at work longer. Thus, CIMCOOL greatly reduces downtime and labor costs for cleaning and changing.

Why not prove to yourself what scientific tests and on-the-job experience have already proved. Put CIMCOOL to the test in your own machines. For a demonstration, just write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

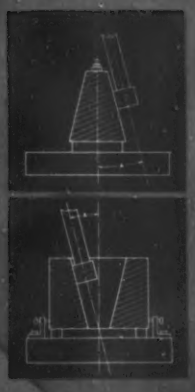
®Trade Mark Reg. U.S. Pat. Off.

CIMCOOL

for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

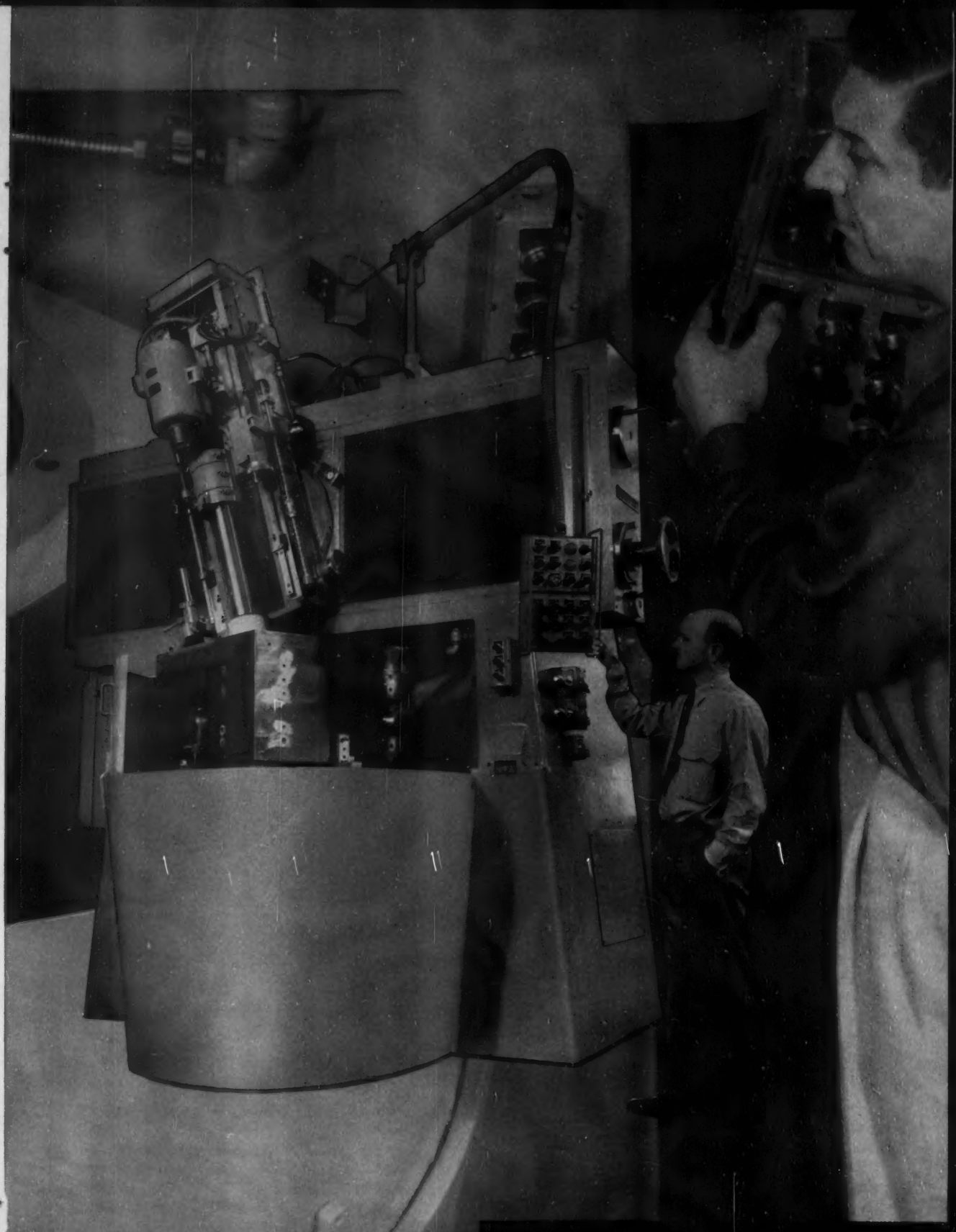
52″swing plus...



. . . plus 27½″ grinding head stroke, 24¾″ clearance over face plate, 42″ diameter face plate—on Springfield's new Vertical Universal Grinder. The work piece on the grinder here is a washing machine agitator mold, 43″ corner to corner. A tapered hole through it must match a conical male part (small illustration). One angle setting of the head ground both male and female taper for perfect fit. It had been planned to hand-lap them, a week's task. Springfield's time: 4½ hours.

Other Springfield Vertical Universal Grinders—swings 21″ and 30″.
Lathes—toolroom, engine, contouring, reproducing—14″ to 32″.
Write for name of nearest Springfield dealer.

67TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS



THE SPRINGFIELD MACHINE TOOL CO., SPRINGFIELD, OHIO

SPRINGFIELD

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Company, Inc. 738 Union Avenue, Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Die Flippers, Motorized Centers and a complete line of Hole Location Accessories.

ACHIEVING PERMANENCE OF ACCURACY

Just as important as the initial accuracy of a precision machine tool is the *life expectancy* of this accuracy. And the most effective way to insure long-lasting accuracy is to give *dimensional stability* and *wear resistance* special consideration during machine design.

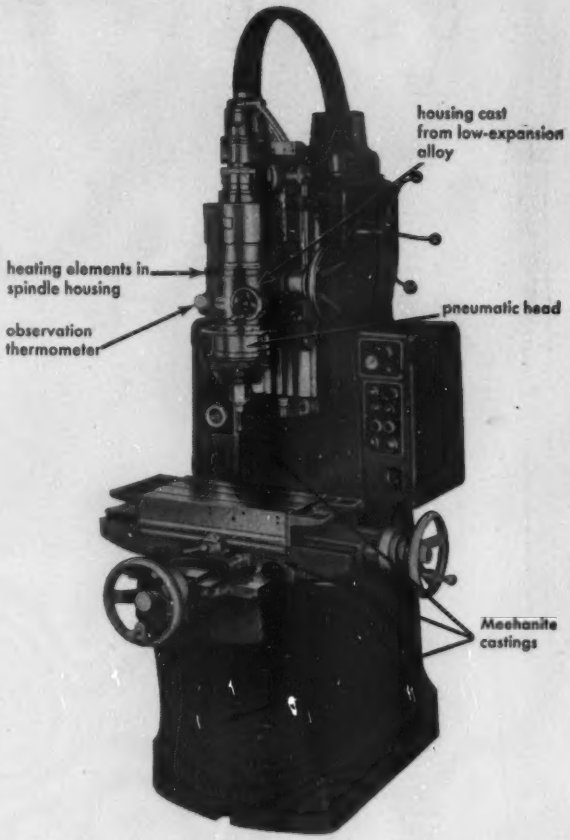
The following causes of dimensional *in*stability are most frequently encountered: thermal expansion, unstable constituents in the material; and stresses in the material. In the design of the No. 2 Moore Jig Grinder, all of these factors were taken into account and special features were incorporated to counteract them.

All the inherent accuracy of a measuring system, capable of positioning the workpiece in relation to the spindle within a tenth, is rendered nearly valueless if the spindle does not retain its position during machining operations. Such movement, caused by thermal expansion, is inevitable unless steps are taken during design to minimize or prevent it.

Electric heating elements were incorporated in the main spindle housing of the Moore Jig Grinder to maintain uniform temperature—whether machine is running or not. An observation thermometer is located so as to indicate any abnormal temperature change within the housing. The housing itself is cast from 36% nickel iron to further minimize effects of temperature variations. And a pneumatic head directs air onto the workpiece, preventing undue temperature rise both in the workpiece and in the locating members of the machine.

Instability resulting from gradual relaxation of locked-in stresses in castings is prevented by suitable stress-relieving cycles during the manufacture of Moore machine components. Similarly, the best way to avoid unstable hardened steel parts is by tempering them. Moore follows this practice.

Further wear resistance was built into the Moore Jig Grinder by means of: adequate way and bearing surface, scientifically proportioned to minimize and distribute wear; all reciprocating parts of nitrided steel—almost as wear-resistant as carbide; pressure lubrication of ways; lead screws and nuts made from nitrided steel and aluminum bronze, respectively, combining to offer low coefficient of friction, abrasion resistance and hardness; and dust protection devices.



Special design features of the No. 2 Moore Jig Grinder insure permanence of accuracy.

ACHIEVING GREATER ACCURACY QUICKLY is the job of Moore Jig Grinders and Moore Jig Borers. Both make possible accurate lead screw settings within .0001". This team will produce precision holes, contours and surfaces *in your shop* at minimum cost. For detailed catalogs, write to: Moore Special Tool Company, Inc., 738 Union Avenue, Bridgeport 7, Conn.

New BOOK for You!

on Stainless Fasteners

This new publication gives you at a glance the complete story on the standard line of American Stainless Fasteners . . . prices, sizes and head styles of wood, machine, and tapping screws. And it gives you a practical check-list of points to consider in selecting the right American Stainless Fastener . . . standard or special . . . for your particular application. A copy is yours for the asking. Write for it today.

P.S.: In developing *special* stainless fasteners, American's "stainless reputation" is your assurance of top results at lowest cost. American engineers will go over your problem with you, any time you say.

SINCE 1838

AMERICAN SCREW COMPANY

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Why stop AUTOMATION at Assembly?

Automation is a new name for an objective long pursued by industry's keenest minds. It means successive elimination of manual operations.

In the production of metal or plastic component parts — by machining, molding, etc. — automation has made advances that in some cases seem almost magical.

By contrast, *assembly* often plods along slowed by outdated methods.

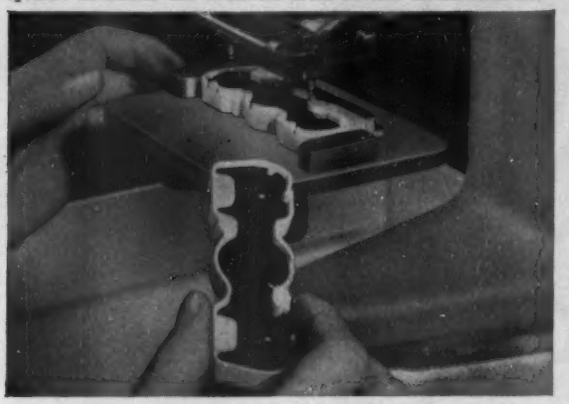
Progress toward automation *does not* end where assembly begins for manufacturers who take full advantage of the P-K Fastening Method. They *eliminate* manual operations like tapping, nut-running, inserts in plastic — and avoid the attendant trouble and expense. Automatic screw driving equipment can be used to further mechanize hand operations on many applications. Savings run up to 50% and more.

Complete automation is, for most, a *distant* dream. Meanwhile, assembly *hands* control your fastening costs. Find out how P-K Self-tapping Screws can *double — even triple* — their efficiency. It *pays* — and pays well — *today*. Talk to a P-K Assembly Engineer. Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14.

PARKER-KALON®

IN STOCK . . . see your nearby P-K Distributor . . .

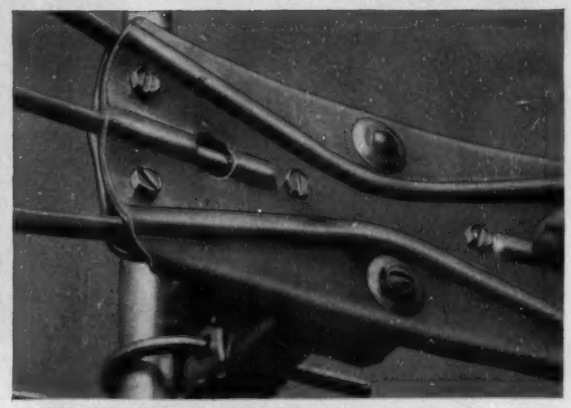
AUTOMATIC DRIVING adds *extra* speed to the faster P-K Fastening Method. Here, an automatic, double-spindle, hopper-fed machine is being used for driving two P-K Type U Drive Screws simultaneously in a plastic electric outlet. Single or multiple spindle machines are available from several manufacturers.



MAYTAG ASSEMBLY MOVES FASTER because fastenings made with P-K Self-tapping Screws are simpler, easier, dependably secure. In the Maytag Dryer shown, 80 Type A and 46 Hex Head Type Z are used, in all, for fastening sheets from 24 to 11 gage — driven with air-operated tools.

with P-K quality—planned assembly savings pay off

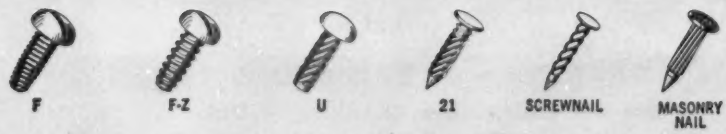
EVINRUDE RELIES ON PROVED STRENGTH of P-K Self-tapping Screws for this critical fastening in an outboard motor sub-assembly, where lasting security is vital. A P-K Binding Head Type F is driven through a die-cast aluminum drive housing and acts as a retainer for the stamped aluminum exhaust baffle.



TELEREX GETS CLEAR PICTURE of performance. For this "Hi-V" Reflector, Telerex, Inc., needed proved resistance to high tension and vibration. They specified 17 slotted Hex Head Z, reasoning soundly that P-K, the *originator*, knows best how to put uniform hardness and toughness in *every* screw.

The Original

SELF-TAPPING SCREWS



your local Supply and Service Specialist

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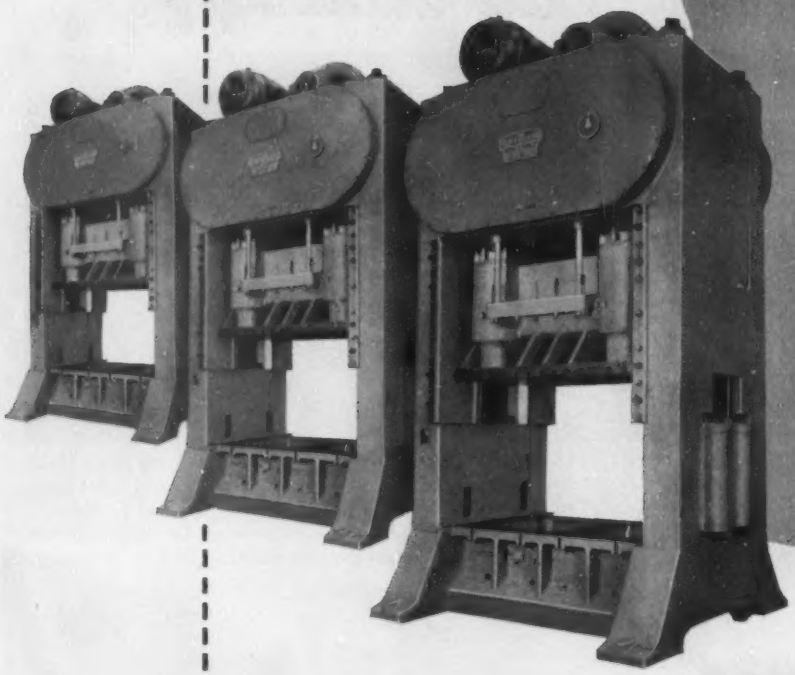
Lower costs?

LINE UP with CLEVELANDS!



You can easily select the exact type and size press for top efficiency on any stamping job from Cleveland's complete line.

The trouble-free Cleveland Drum Type Clutch gives you positive, instantaneous slide control. Its greater accuracy means fewer rejects. Lightweight and easy to maintain, it cuts press operating costs.

Make your new presses Clevelands. A Cleveland engineer will gladly help you choose the right model Clevelands for economical press production.

A-8107

Cleveland 4 Point Presses equipped with Cleveland (Patented) Drum Type Clutch

Stroke of slide	18"
Adjustment slide	12"
Shut height	54"
Bed and slide area	60x84"
Capacity	450 tons

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Established 1880

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CONCEALED VALUES THAT PAY $ $ $

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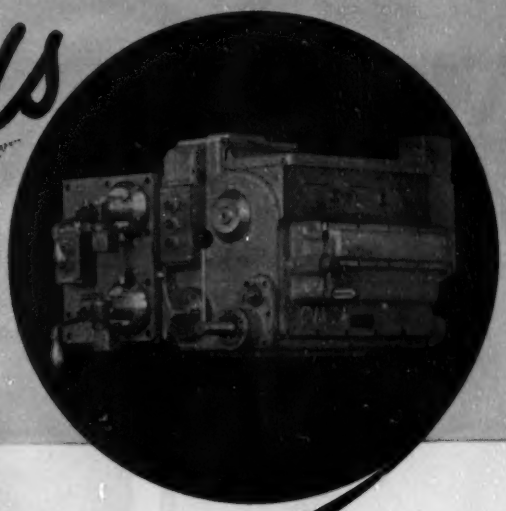
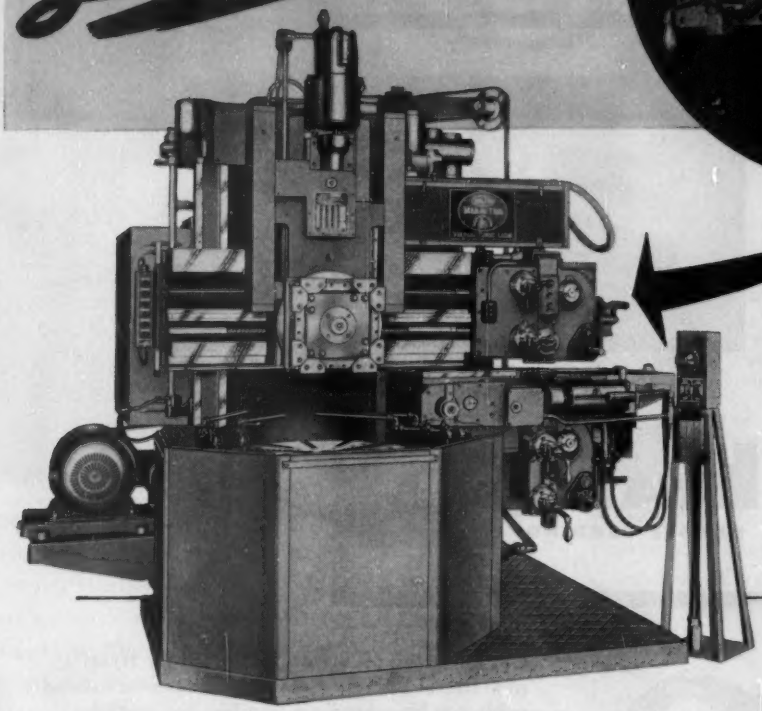


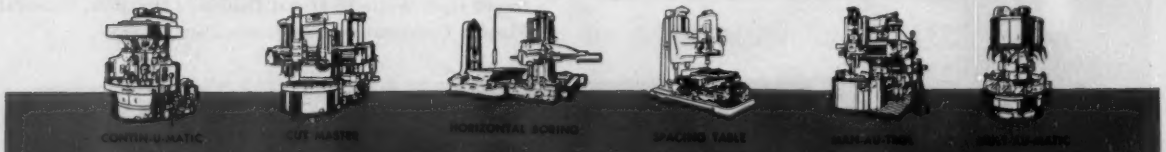


MAN-AU-TROL CONTROLLER

Electrical and hydraulic functions combined to initiate and complete a pre-selected sequence of operations including direction and rate of feed, direction of power traverse, indexing of turrets and changing of spindle speeds automatically, accurately and repetitively.

BULLARD

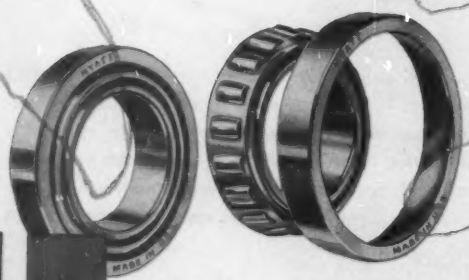
The refinements of design and construction in Bullard Machine Tools incorporate many "concealed values" which provide for ease of operation, cutting time between cuts and on cuts, accuracy in machining repetitive dimensions with less spoilage and minimum maintenance time resulting in higher over-all productive time. . . . . The Man-Au-Trol Vertical Turret Lathe can be controlled either manually or entirely automatically at the operator's discretion to best meet the requirements of the job at hand. For complete details on this versatile machine, call your Bullard representative or write to



THE BULLARD COMPANY · BRIDGEPORT 2, CONN. Tel. EBison 6-2551

Always within easy reach . .

Hyatt's New Line of Dual-Purpose, Self-Aligning BARREL BEARINGS!



Got a bearing problem? Just reach for Hyatt's new Barrel Bearing Catalog! This is one catalog engineers have been waiting for, because it's essentially *a guide to lower maintenance costs!* Barrel Bearings are not only dual-purpose in design; they're also *self-aligning*. They operate with full efficiency under misalignment conditions which cause excessive wear in ordinary bearings. If *your* job involves bearing specifications, make sure you have Hyatt Catalog No. B-154. It puts a complete line of Barrel Bearings right at your finger tips. Write to Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT

STRAIGHT ROLLER BARREL ROLLER TAPER ROLLER

FRIDEN Calculating Machine Co., Inc. of San Leandro, Calif., makes these components on CLEVELAND 3" Model AB DIALMATICS...

. . . to such accuracy they are assembled into precision aircraft navigation instrument without further machining other than some deburring!

John Prohaska, vice president of Cleveland Automatic and Jay DiFabio, test department foreman, admiring aircraft instrument components produced by the Friden Company on two Cleveland Dialmatics—identical to the machines shown in the background. Friden produces these parts in runs of from 500 to 2000 pieces.

Shown are a few of some 30 instrument components produced on two Cleveland Dialmatics at Friden Calculating Machine Co., Inc. Machined from aluminum and stainless steel, these parts are characterized by extremely thin sections—intricately stepped and recessed i. d.'s—many trepanning operations—fine pitch threading—clean, sharp knurling—beautiful finish—*with most dimensions held to* 0.001"; *many to* 0.0005".

That these parts are produced *complete* on the Cleveland Dialmatics—rather than first roughed out, then finished to required tolerances by grinding—is a tribute both to the skillful tooling by Friden engineers and to the capabilities of the Cleveland Single Spindle Automatics. The Cleveland's rigidity and accuracy of operation—range of spindle speeds—flexibility of control—ease and rapidity of set up—contributed to produce some of the finest screw machine work we have ever seen.

Could a single spindle bar automatic possessing these qualifications assist *your company* to more and better production at less cost? Let a Cleveland sales engineer give you complete information. For a description of machine details and specifications, write for new 8-page bulletin.

Remember: *Clevelands Cut Costs*

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
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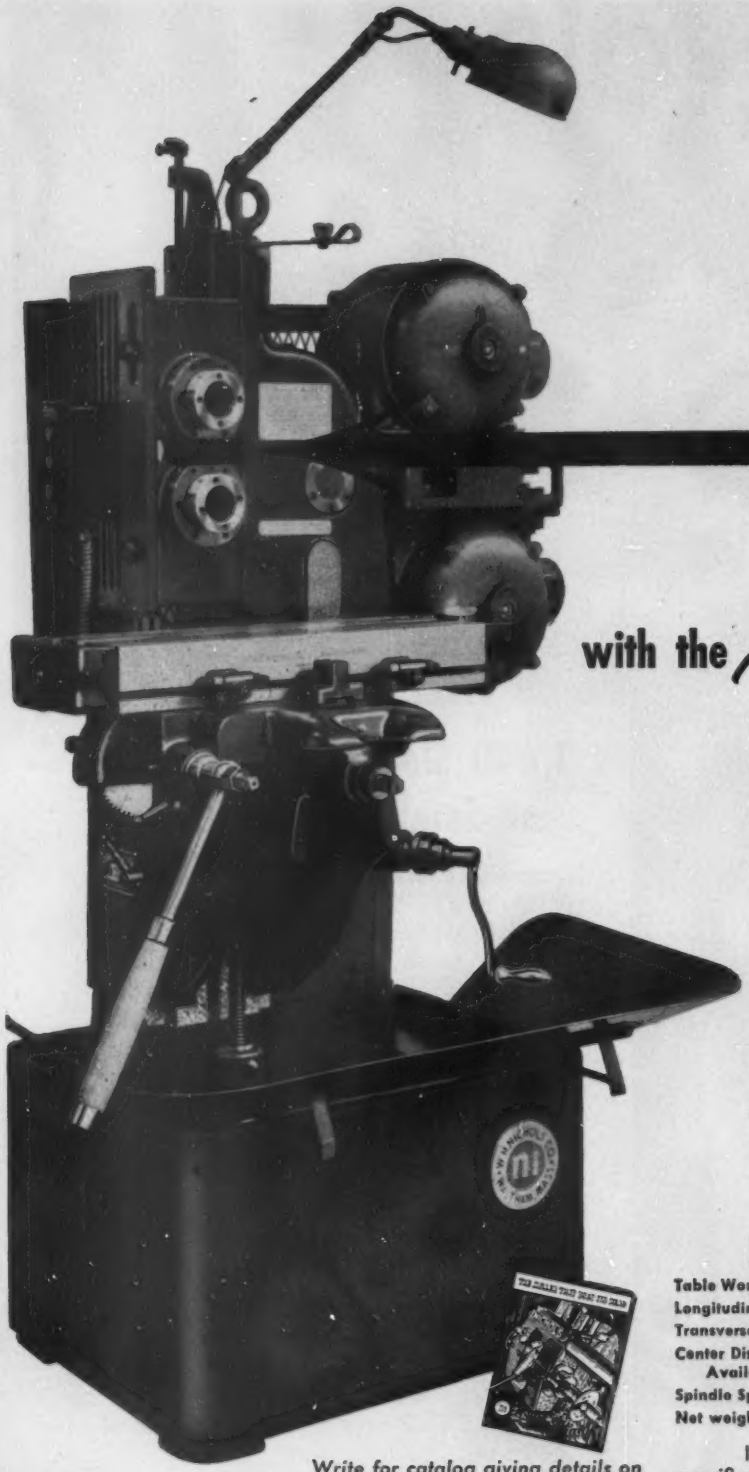
Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines



TWO FOR ONE

with the *Nichols* Double-Decker!

The Nichols *"Double-Decker"* Two-spindle Miller actually gives you *two* milling operations in *one* pass! It is equally adaptable to small or large lot production of small parts where parallel flats or grooves, or opposed faces cannot be straddle milled, or otherwise must be indexed for two operations with a single cutter. Its time-saving features are readily apparent. Spindles may be separated from 4" to 7" (or more) to accommodate various sizes of cutters and work. Table can be arranged for hand operation or with automatic work cycle, and with high or low spindle speeds.

CONDENSED SPECIFICATIONS

Table Working Surface	6¼" x 21"
Longitudinal Travel	10"
Transverse Travel	7"
Center Distance of Spindles Available Between	3¾" and 14⅜"
Spindle Speeds Available	up to 5000 R.P.M.
Net weight approx.	1250 lbs.

Inquiries must be submitted in detail, as specifications and capacities are governed by user's needs.

Write for catalog giving details on lever, screw and air-feed models, plus three types of double spindle Nichols Millers.

MANUFACTURED BY W. H. NICHOLS COMPANY WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

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Expertly fashioned by hand, this engraved, finely-balanced, ceremonial sword is our outstanding example of the armorer's art.

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Dress sword carried by General H. K. Olliver of the Ancient and Honorable Artillery Company of Boston in 1845.

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Two Lipped
Straight Shank
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Long
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OWNERS AND OPERATORS OF: S. W. CARD MANUFACTURING CO. DIVISION, Mansfield, Mass.
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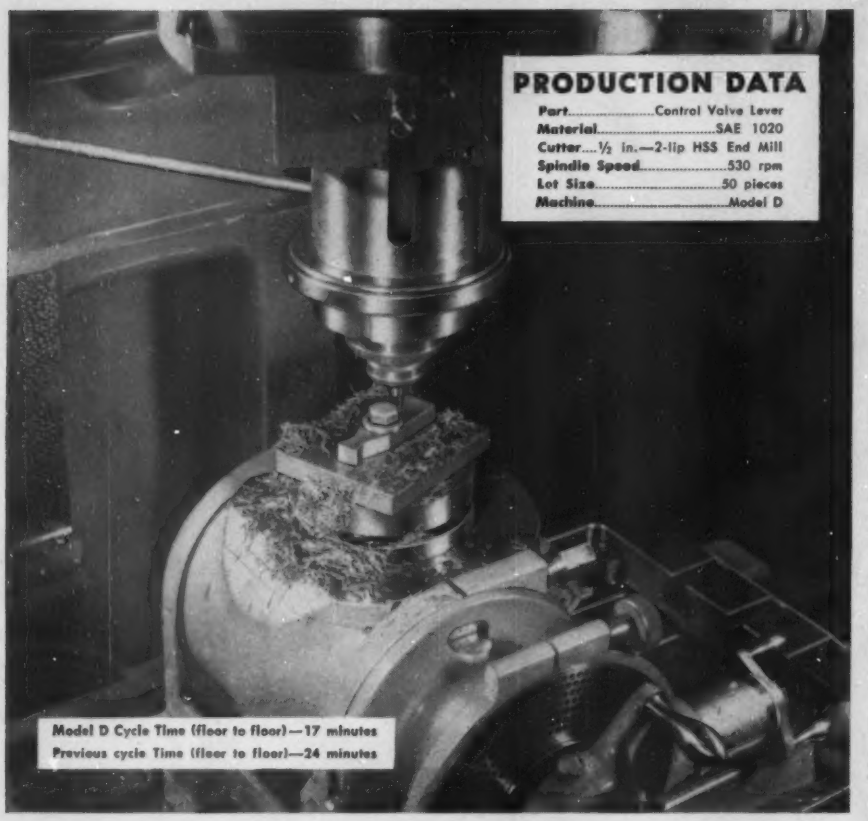
CUT INVENTORY COSTS, ORDER FROM YOUR LOCAL DISTRIBUTOR

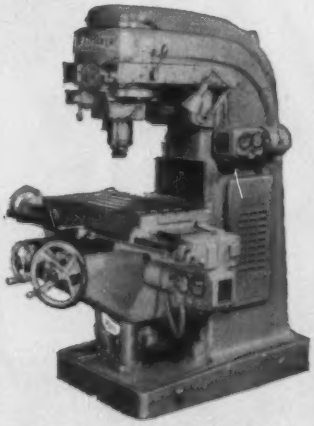
This part is finish milled direct from the blueprint, with a single setup, in 17 min.!



Kearney & Trecker Model 2D Rotary Head Milling Machine saves six hours on 50 piece run

HERE is another example of the tremendous time and tooling savings possible with the rotary head milling method.

This manufacturer used to complete a control lever every 24 minutes. Now the same work is completed in only 17 minutes... and no multiple setups or expensive form cutters are necessary. The blueprint is the only guide the operator needs — the machine's precise mechanical control of the cutter's angular and radial movements does the rest.



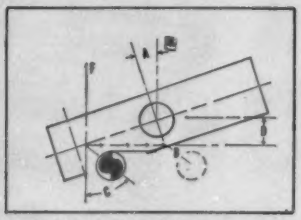
Here's the Rotary Head Milling Machine Production Idea Booklet. It contains several examples of how this method has been found exceptionally efficient in solving production, die, forging and metal pattern milling problems. It's yours for the asking.

Address requests to Kearney & Trecker Corp., 6784 W. National Avenue • Milwaukee 14, Wisconsin

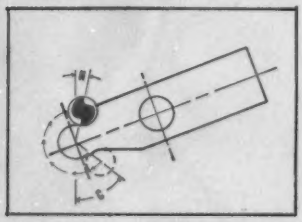
NOTE: this machine available under Kearney & Trecker's Tool-Lease Program

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

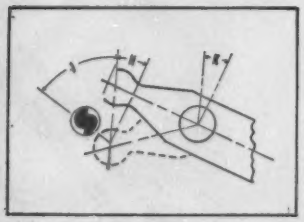
THIS IS THE MACHINE that will handle your light production milling faster, easier and at tremendous savings over any other method. If you have any production problems in plastic molds, die-casting, forging and stamping dies, or selected production milling operations — investigate the Model 2D.



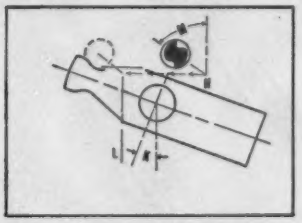
1. MILL 20° ANGLE. Index piece to angle (A), offset spindle slide to radius (B), set rotary head to angle (C), saddle to (D). Feed table (E) to (F).



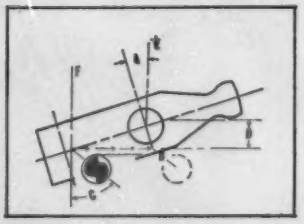
2. MILL .642/.645 DIAMETER. Rotate head angle (C) to angle (H).



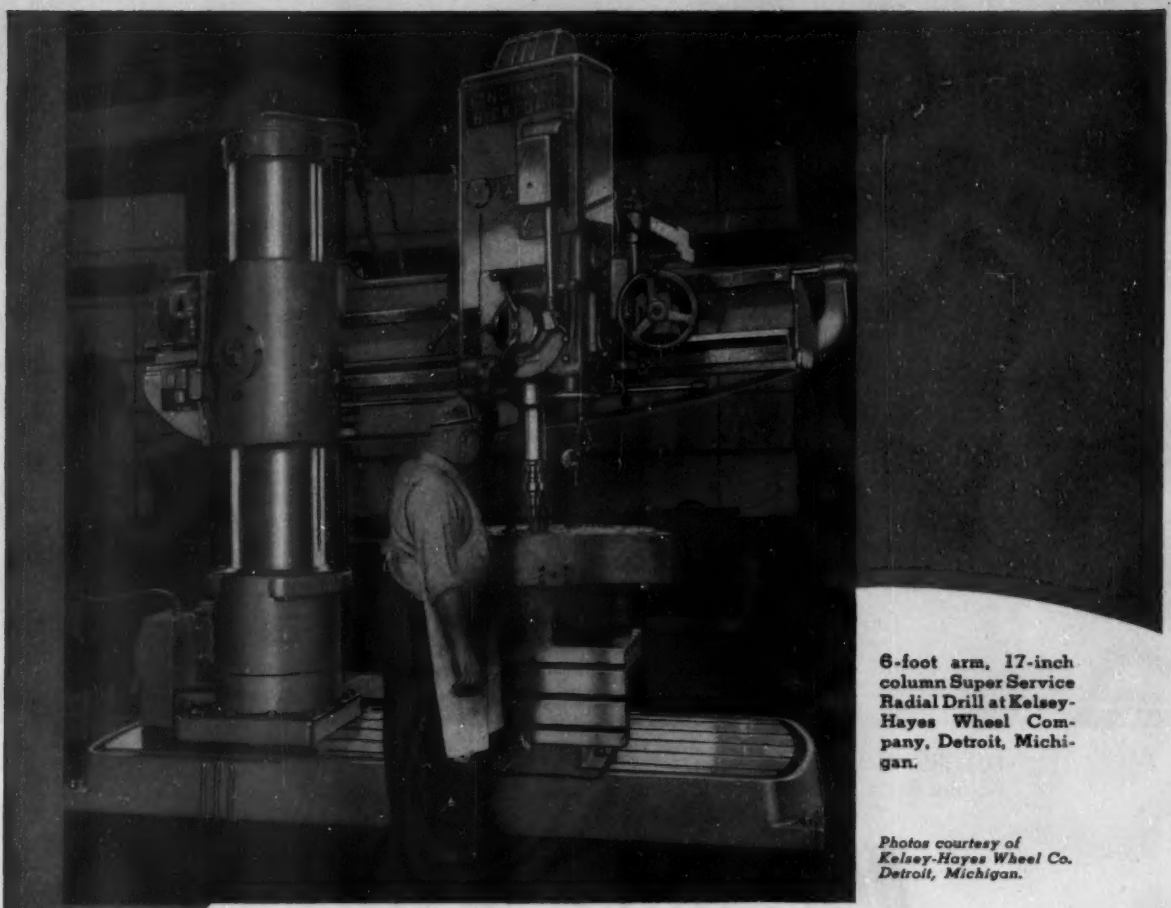
3. MILL 1⅛ IN. RADIUS. Rotate head fromangle (H) to angle (J), index dividing head from angle (A) (Oper. 1) to angle (K).



4. MILL 20° ANGLE. With piece at (K), move center of head to (L); rotate head to (M). Feed table (L) to (N).



5. MILL SAME FORM ON OPPOSITE END. Repeat operations 1 through 4 by indexing the workpiece to angle (A-Oper. 1).



6-foot arm, 17-inch column Super Service Radial Drill at Kelsey-Hayes Wheel Company, Detroit, Michigan.

Photos courtesy of Kelsey-Hayes Wheel Co. Detroit, Michigan.

A typical tool-room job, involving a wide range of speeds and feeds, and extreme accuracy.

"excellent

IN OUR TOOL ROOM"

The tools, dies and fixtures for the mass production of Kelsey-Hayes wheels, brake-drums and other automotive parts can only be produced on accurate machines. Since 1930 Cincinnati Bickford radial and upright drills have been used here. The machine shown above, recently installed, is rated "excellent" by this user, because of its many features for accuracy, ease of operation, safety, and productive capacity. Investigate these advantages of Super Service Radials—Write for Booklet R-29.

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Cincinnati 9, Ohio, U.S.A.

CUTTING. New S.E.C.O. keeps parts and tools cooler. Tools last longer, require fewer grindings; production is increased; finishes are uniformly good.

Now Better Than Ever!

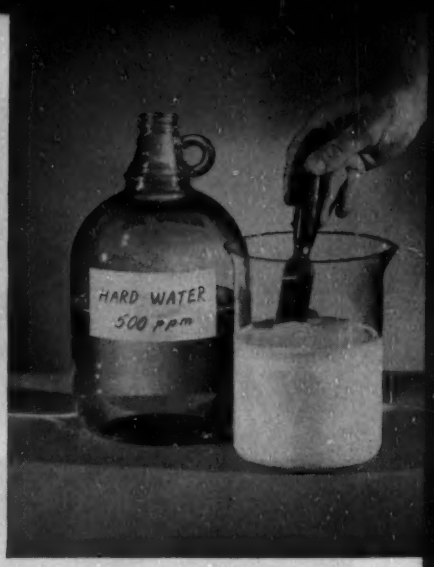
Sunoco Emulsifying Cutting Oil

New refining facilities improve industry's most widely used cutting oil and permit it to give these added benefits

- **HIGHER MACHINING EFFICIENCY**—better finishes, longer tool life, increased production in cutting operations
- **INCREASED DETERGENCY**—particularly important in grinding operations—provides better surface finishes, prevents loading and glazing of the wheel, prolongs wheel life
- **BETTER MIXING QUALITIES**—in hot, cold or hard water
- **A PURER, CLEANER CUTTING OIL**—whiter, more stable emulsions; cleaner parts and machines; better operator acceptance
- **EASIER HANDLING**—pumps from storage tanks more readily, flows from drums faster
- **GREATER VERSATILITY**—can be used for rolling, washing and rustproofing as well as cutting and grinding

MIXES BETTER IN HOT WATER. New S.E.C.O. mixes and remains stable even at 180 F. This permits its use in washing and rustproofing.

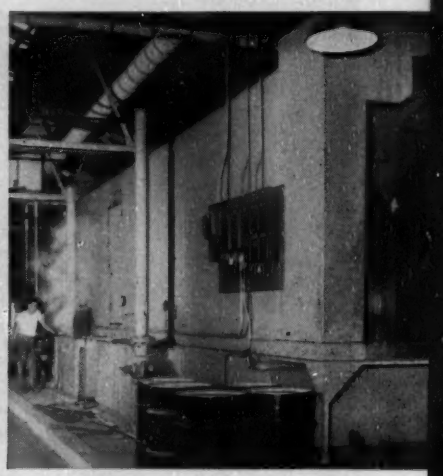
MIXES EASILY IN COLD WATER. New S.E.C.O. forms stable emulsions in the coldest water . . . even ice water does not affect it.



MIXES READILY IN HARD WATER. New S.E.C.O. eliminates the need for special hard-water grades of emulsifying cutting oil.

GRINDING. New S.E.C.O. improves surface finishes because its increased detergency prevents loading and glazing of grinding wheels, prolongs wheel life.

RUSTPROOFING. New S.E.C.O. is a better hot rustproofing medium. It forms stable emulsions, coats metal parts uniformly, protects them against rusting.



WASHING. Because of its increased detergency and its ability to mix and remain stable in hot water, New S.E.C.O. is better for removing grease and dirt from metals.

TEST THIS NEW S.E.C.O. IN YOUR OWN PLANT. For more information, call your nearest Sun office or write SUN OIL COMPANY, Phila. 3, Pa., Dept. AM-6.

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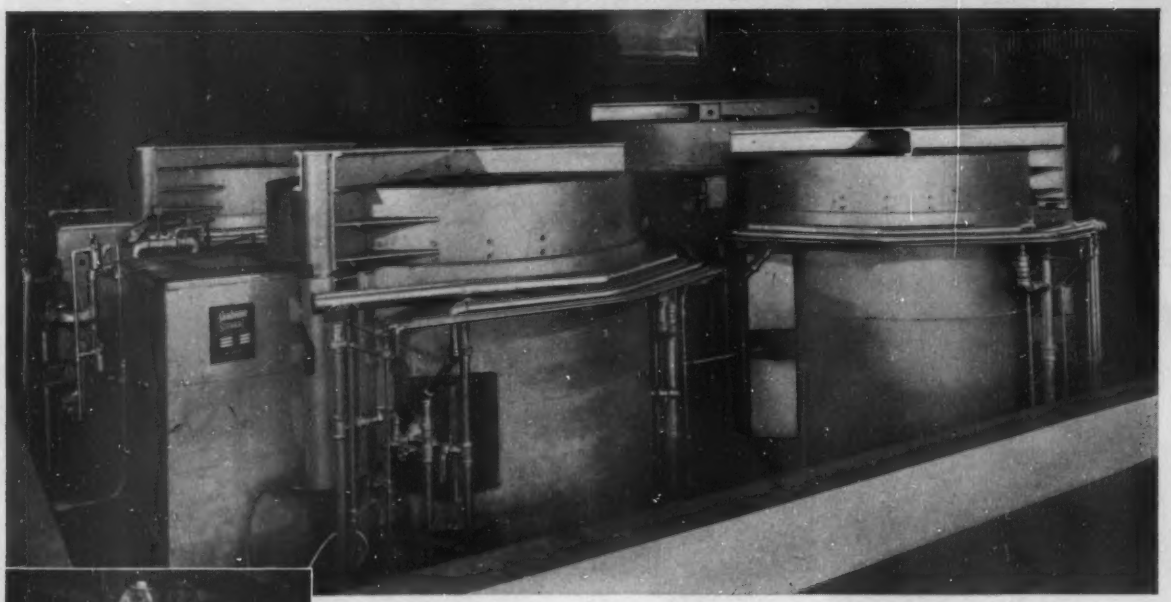
HOW SUNBEAM FURNACES HELP MANUFACTURERS REDUCE COSTS AND KEEP THEMSELVES COMPETITIVE

HEAT TREATING CAST STEEL RAILROAD WHEELS

At GRIFFIN WHEEL COMPANY, Chicago, Illinois



This Sunbeam Stewart heat treating installation consists of four direct fired furnaces having a usable pit depth of 13 feet. Griffin Wheel's method of manufacture and heat treatment has provided a wheel of high wear resistance, high strength and impact values and excellent resistance to fatigue. This program of development in perfecting the new wheel required over ten years.

Workman removing a cast steel railroad wheel from one of the four Sunbeam Stewart Furnaces. Capacity of each heat treat furnace is between 18 and 20 wheels, each weighing approximately 600 pounds.

To withstand the high stress and impact values of ever-increasing loads and speeds of modern freight cars, Griffin Wheel Company has developed and placed in manufacture a newly designed cast steel wheel, having strength values considerably greater than the present chilled cast iron wheel. To obtain the physical characteristics required, the ascast structure has to be highly refined through accurate heat treatment.

The wheels are placed in a continuous soaking oven where they are allowed to equalize at approximately 1000°F. While still at this temperature wheels are charged into one of four Sunbeam Stewart Pit-type furnaces, temperatures being raised to 1550°F. for a thorough soaking. Capacity of each heat treat furnace is between 18 and 20 wheels which is equivalent to the heat of steel as produced by the melting furnaces. The Sunbeam Stewart furnaces have a usable pit depth of 12½ feet. Wheels are supported at the bottom by hard pressed firebrick piers capped with a 14½ inch diameter high nickel chrome alloy pier-cap.

This Sunbeam Stewart furnace design provides even heating and close temperature control with minimum fuel costs. The burners are divided into two temperature control zones—one for the upper and one for the lower section of the furnace. Each is equipped with its own control valves, safety equipment and controlling and recording pyrometer.

MODERN AUTOMATIC HEAT TREAT EQUIPMENT MAY BE THE ANSWER TO YOUR PROBLEM

Sunbeam engineers can help you keep pace with modern production methods. Replacement of obsolete or inefficient heat treating equipment with an automatic Sunbeam installation reduces costs, improves quality, pays for itself in a short time.

Sunbeam CORPORATION (Industrial Furnace Division)

Main Office: Dept. 119, 4433 W. Ogden Ave., Chicago 23—*New York Office:* 322 W. 48th St., New York 19—*Detroit Office:* 3049 E. Grand Blvd., Detroit 2

A letter, wire or 'phone call will promptly bring you information and details on SUNBEAM industrial furnaces, either units for which plans are now ready or units especially designed to meet your needs. Or, if you prefer, a SUNBEAM engineer will be glad to call and discuss your heat treating problems with you.

...another MORRIS MOR-SPEED production machine

OPERATIONAL CYCLE:

Station	1	Load and Unload
Station	2	Drill two 57/64″ holes Drill four 29/32″ holes
Station	3	Spot face six holes
Station	4	Ream (.9062″) two holes

Drilling six large holes in armor plate forgings is no cinch, but when you want a finished part every minute and twenty seconds, that's a tough problem. To Morris Engineers, it was a familiar problem... precision drilling on a mass production basis!

The machine furnished was a MOR-SPEED Four Station Vertical, giving "special machine" production and precision at remarkably low cost. Standard base, rear column, indexing table, slide and hydraulic feed mechanism are combined with special multiple drilling head and work fixtures . . . to make up this high production machine.

Consider the savings . . . investment, labor, time and floor space . . . offered by Morris MOR-SPEED Machines. Precision high production can be yours for less than you might imagine!

Morris

933 HARRIET STREET CINCINNATI 3, OHIO

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The Reamer Specialists

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CHICOPEE, MASS.

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Right You Are

I would like an explanation of how a rotating flycutter can mill a sphere by using a single-point tool and the method suggested by Mr Louis Saiia (*AM*—April 26 '54, p136). I am of the opinion that the portion of the blank between the tool point and the axis of the shank would not be touched.

E Allsman
Victory Tool & Die Co
Fresno, Calif

Several readers have brought this to our attention and have pointed out that such an arrangement will not mill a complete sphere but, rather, will leave a sort of truncated cone at the top of the work. As a matter of fact, if this method were capable of forming a perfect sphere, the sphere would drop off the shank at the completion of the cut, because such a method produces a symmetrical workpiece.—ED.

For Your Files

In reference to that item in Talking Shop (*AM*—April 26 '54, p149), I just can't help wondering whether the operator of that automatic file-making machine in the Ontario jail is allowed to distribute samples. Or is this one of those prisons-without-bars that we hear about?

J Blanchard
Chicago

New Name

I note that in several of your recent issues you have referred to the technique of removing metal by means of an electrical discharge as "Electrical Discharge Machining." The term is descriptive but somewhat clumsy. May I be permitted to suggest that we have a better name in this country? We employ the term "Electro-Erosion."

Not only does this more truly describe the process, but it covers the several different processes of machining by electrical discharge, as well as by abrading with a tool vibrated at ultrasonic speed.

GRINETICS

BY D G SMITH

REPLACEMENT PART

SELF ALIGNING

SHIPPING CONTAINER

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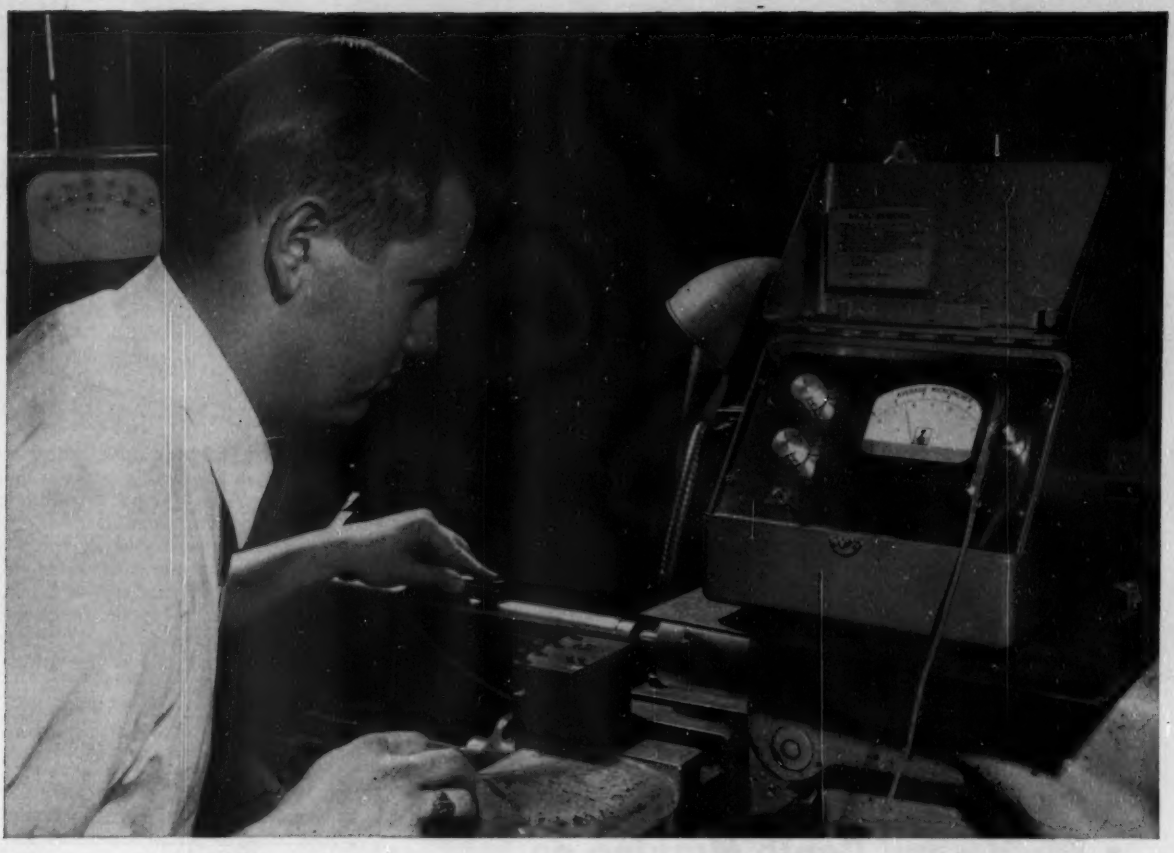

BRUSH SURFINDICATOR used to measure surface roughness of a titanium bar in a test lathe, at Metcut Research Associates. The company uses the instrument in evaluation of cutting tools and fluids, and determination of machining characteristics of various metals.

"SURFINDICATOR*—Indispensable in studying machining characteristics!"

"We have found the Brush SURFINDICATOR* indispensable in our research and development programs on machineability. The evaluation of cutting tools and materials requires accurate measurements of surface finish, for which the SURFINDICATOR is a most useful tool. It can be set up quickly, it is simple to use and its small head permits measuring a wide variety of metal parts."

—Metcut Research Associates, Cincinnati, Ohio

TRY IT YOURSELF! The Brush SURFINDICATOR makes the measurement of surface roughness a quick and easy operation. It can be set up anywhere in the plant where 115 volts a.c. is available. Write for a copy of this booklet describing surface finish control—or ask for a demonstration of the SURFINDICATOR in your plant. Send coupon now. Brush representatives are located throughout the U.S. In Canada: A. C. Wickman, Ltd., Toronto. Brush Electronics Co., Cleveland 14, Ohio.

*Trade-Mark

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PIEZO-ELECTRIC MATERIALS • ACOUSTIC DEVICES
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☐ Have your nearest representative demonstrate the SURFINDICATOR to me.

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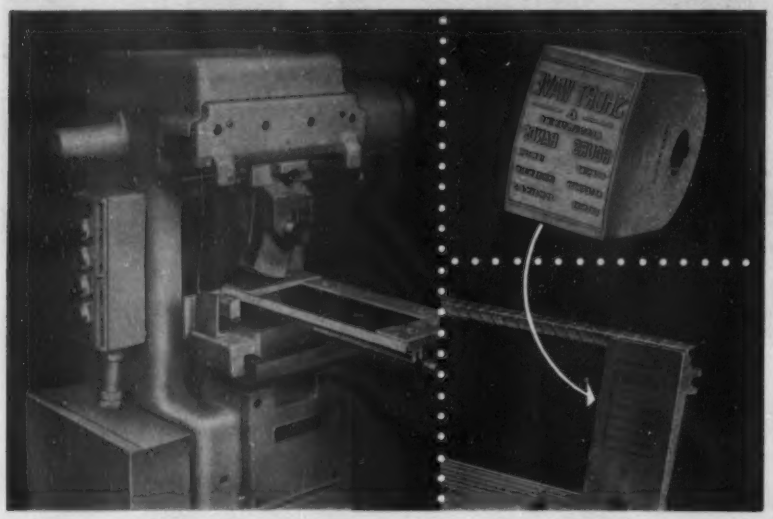
LEADERS IN INDUSTRY MARK WITH NOBLEWEST

RECIPROMATIC

MULTIPLE PASS ROLL MARKING MACHINE



Noblewest's RECIPROMATIC Model 50P1 used for marking portable short wave radio panels with a sharp, permanent, extra-deep impression. Upper right shows Rocker Marker Die and marked panel below.

- **For Extra Deep Marking**
- **For Normal Depth Marking on Fragile Parts**

Another NOBLEWEST mark of achievement! This job required unusually deep marking on die cast parts which would have been fractured by marking the impression with straight pressure. But with the Noblewest *Reciprocatic*, a permanent, extra deep impression was *rolled* into the metal by several passes of the die . . . without distortion . . . or fracture.

Among the many features of this Reciprocatic ROLL-O-MARK all-pneumatic marking machine is a special control circuit which permits any number of roll marking passes to a given part . . . air-operated work table which provides uniform marking pressure and compensates for dimensional variations in piece parts.

Whatever your needs for metal marking, Noblewest makes the machines, tools and dies for doing the complete job faster, better, at lower cost. And remember, Noblewest Roll-Marking is *permanent* marking—*good for the life of your product.* There is a Noblewest representative near you. Write to Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Connecticut.

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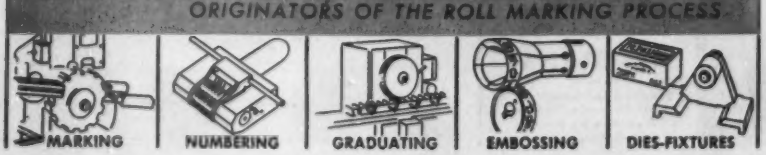
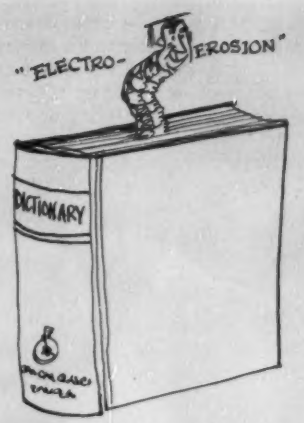
NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS





I am not criticizing your choice of words; when any new process is developed there is always a problem of finding a word that describes it adequately and is easy to use and remember. You Americans seem to have a genius for that sort of thing, perhaps because of your rapid-fire style of speech, but I really think we have "beaten you to the draw" this time.

R St J Appleby
Coventry, England

Help Wanted

In connection with the preparation of a HANDBOOK OF NOISE REDUCTION ENGINEERING, to be published by McGraw-Hill, this inquiry is directed to industrial firms having noise studies in their plants or noise analyses of their products, either in various stages of design or in production testing. The new book, which covers all phases of noise, its control and effects on man, places special emphasis on noise problems in industry and their solutions.

Please forward any suitable data to Prof Cyril M Harris, Acoustics Laboratory, Columbia University, 632 W. 125 St, New York 27, N Y, together with a statement indicating how such data are to be credited.

Cyril M Harris
New York City

Not So

I think Peter Grant (*AM* — May 24 '54 p90) is just going out of his way to ridicule Mr Engle's article (*AM* — April 26 '54, p105). He is adopting the attitude — so common among shop employees these days — that a man should do just and only what he is told to do. If he runs out of work and has to loaf for half an hour, that's no skin off his nose; it is up to the boss to see that he is kept busy. That kind of an attitude only results in getting you disliked by the boss, and even though the Union

will protect you to a great extent, it is never a good idea to be in wrong with the top brass. You can't expect favors — and who doesn't want a favor now and again — if you are not willing to play along and pull your weight for the good of the company.

This doesn't mean you have to toady to the boss, bring him presents, or be palsey-walsey with him. It merely means you have to respect the fact that there is as much dignity in doing a good job, and doing it efficiently, as there is in being the plant manager.

William Crouch
Philadelphia

The Vanishing Toolmaker

The industry today is losing another landmark. The era of the toolmaker, sad to relate, is slowly coming to an end.

Nostalgic memories of the long haired, slightly stooped monarch of the toolroom, surrounded by belt-driven lathes, are fading; and the line shaft from which he found music, has been stilled. No longer is he looked upon as the Master Mechanic of the plant. No longer is he the sole authority in matters mechanical.

Blueprints, machines, and men are becoming highly specialized. Each has been channeled, improved and, in most cases, has been set up almost as a production department.

Increasing competition, sharper buying, and cost of production have brought the industry to this change. The need for apprentices, and men trained in all phases of toolmaking has dropped sharply; knowledge of only one machine is all that is required. However, the need for this change is essential, and one that must come if the industry is to survive and grow.

As the toolmaker of yesteryear gazes about him to view this scene, he may well wonder what has become of the magic and mystery that once held him in awed silence as he formed from misshapen pieces of steel, tools that were to run the machines of industry. The industry that he helped build, but whose pace has made him obsolete. For him the magic is still here, he has known his trade and has kept it alive within himself, even through this crisis. Those who follow him will never know this creative feeling.

Yes, the toolmaker must go. Even so, it seems a great loss to the toolroom not to see man and machine work together as one, both giving, as well as receiving.

Robert E Novak
St. Louis

OLIVER ACE

Universal Tool and Cutter Grinders

Are BEST for Your Toolroom

Because . . . they handle a wider range of cutters than ordinary cutter grinders — only two simple fixtures required.

The Oliver ACE requires no computation . . . its direct reading for clearances eases operators' jobs in grinding the most difficult cutters. Extremely accurate, the ACE has only one sliding part with ample bearing, efficiently protected from dust. Surpassing the usual requirements for precision, speed and economy, the Oliver ACE is especially qualified for the grinding of tungsten-carbide and high speed milling cutters and tools — jobs it tackles with amazing ease.

The proved, dependable and soundly engineered Oliver Ace Universal Tool and Cutter Grinder substantiates Oliver of Adrian's world-wide reputation of 4 decades as a designer and builder of longer lasting toolroom machinery. This truly superior type machine is simple to set up and requires only a minimum of floor space.

Along with thousands of others — Be Wise—OLIVERize Your Toolroom—NOW.

Direct Reading for Clearance

—Reduces Fatigue

—Eases Operators' Jobs

Priced to meet your budget, the ACE excels for grinding face mills up to 15"—also, slab mills • slitting saws • dovetail cutters • angular cutters • double angle cutters • Fellows helical cutters • reamers • taper reamers • production gashing and carbide tipped circular saws.

2 MODELS: Standard and Heavy Duty (illustrated)

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AUTOMATIC DRILL GRINDERS
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from **American Machinist** to **you** this year:

26 sharp-focused issues . . . packed with the indispensable help and ideas that

Every other week, your copies of *American Machinist* bring you the top ideas and facts we can find on how to manufacture better metalworking products more efficiently. They are the kind of ideas and facts which are important enough to have long-lasting value . . . and you confirm this by asking for more than 300,000 reprints of *American Machinist* articles a year.

How, then, we have long asked ourselves, can the great wealth of information a year's issues of *American Machinist* provide be made as *easily* and *permanently* available to you as possible? And *this* is the year in which the best answer we've ever found is coming your way in our November PRODUCTION PLANBOOK issue. Look at this!

In eight cohesive, carefully indexed sections, the 1955 PRODUCTION PLANBOOK will give you in *very brief form* (no more than a short paragraph per item in most instances) all the important leads to better production that a full year of *American Machinist* issues have brought you in detail. The result will be very much as though, all through the year, you'd made an index-card summary of every *American Machinist* article . . . and filed it away on your desk top for the indispensable help it could offer in solving your daily production problems.

Machining . . . tooling . . . materials . . . finishing . . . heat-treating . . . *whatever* the problem today or tomorrow brings, you'll find an answer or an important clue to its solution in one or more of the PRODUCTION PLANBOOK's eight cohesive sections.

Eight sections we said? Actually, there are ten . . . but the other two will be devoted to *special* PRODUCTION PLANBOOK reports on subjects of high and lasting importance to you. More about them in later issues of *American Machinist* . . . but know *now* that the magazine whose helpful value draws far more subscribers than any other metalworking magazine published is on its way, with the 1955 PRODUCTION PLANBOOK, to being a more helpful, time-saving publication than ever!

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a great **PRODUCTION PLANBOOK** issue
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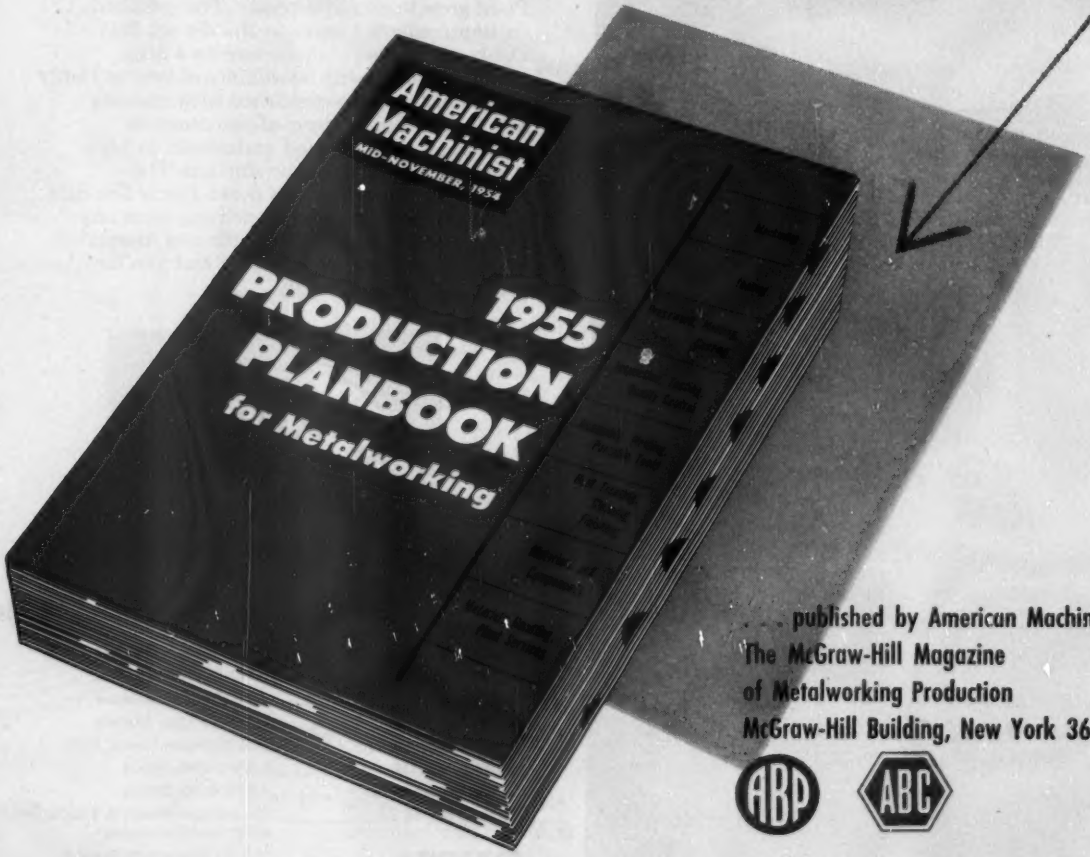
than any magazine issue has ever offered before



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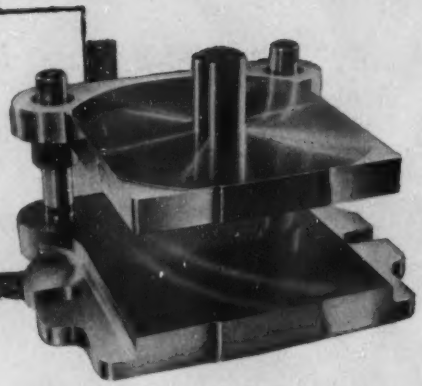
The McGraw-Hill Magazine
of Metalworking Production
McGraw-Hill Building, New York 36

ABP ABC

World's fastest die set service in action



Here's where faster die set service begins, on Danly's high speed precision production lines . . . the finest mass production facilities in the die set field.

Here's where your order is received . . . in one of Danly's Branch Plants. Because all die components are close at hand, your order is filled immediately.

Now—Danly unites mass production techniques with the precision touch of craftsmanship to bring you the fastest die set service . . . ever.

Never before has there been a die set service as fast as the one that Danly now offers to you. Unique in concept, the system had its beginning some years ago when Danly originated its network of nationwide Danly Branches. Under such a system the main Danly Plant in Chicago provided thousands of *interchangeable* die set parts to Danly Branch Plants. It meant that such parts were easily assembled into standard die sets and then quickly delivered to meet the requirements of any tooling program.

But, as buyers recognized the convenience of Danly service, demands on the Chicago Plant grew to exceed capacity. The solution? . . . an unprecedented move in the die set field. Danly put die set manufacture on a mass production basis with no sacrifice of famous Danly precision. It was accomplished with amazing new facilities in the form of two complete production lines devoted exclusively to high speed, precision die set production. The next time you put one or a dozen Danly Die Sets on order, expect to get fast delivery from any Danly Branch, expect to get die sets unequaled in precision. You can expect it and you'll get it . . . when it's Danly.

DANLY®

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

Fast, nationwide delivery from these plants

***CHICAGO** 50	2100 S. Laramie Avenue
***CLEVELAND** 14	1550 East 33rd Street
***DAYTON** 7	3196 Delphos Avenue
***DETROIT** 16	1549 Temple Avenue
***GRAND RAPIDS**	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
***LONG ISLAND CITY** 1	47-28 37th Street
***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
***PHILADELPHIA** 40	511 W. Courtland Street
***ROCHESTER** 6	33 Rutter Street

**Indicates complete stock.*

Spot News of Metalworking . . .

- **COLD GEAR-ROLLING . . .**
  Only slightly larger than an office desk, an automatic cold gear-rolling machine developed by Ben Grob Corp, Grafton, Wis, is said to have out-produced two eight-spindle rotary hobbers in a recent test for producing splines on rear axle shafts at a major auto company. (see p169)

- **RUSSIAN AUTOMATION . . .**
  Reported recently by Russia's official newspaper, *Izvestia*: an automatic line at the J V Stalin Combine plant that can make 180 meters of link chain per hour from steel strips. Also reported are 12 automatic lines in other farm machinery plants, for making everything from tractor plow-shares and combine cutting heads to rake teeth and nuts and bolts.

- **FORM SUBCONTRACTOR GROUPS . . .**
  Two rival defense and/or aircraft industry subcontractors' associations have been set up on the West Coast. Purpose of both groups (and there's no love lost between them) is to see that small subcontractors don't get the short end on defense procurement. Both groups have their eye on nationwide membership.

- **BUBBLES . . .**
  Soap bubbles are being studied by metallurgists at General Electric's Research Laboratory in attempts to develop stronger metals. Soap bubbles, while individually globular, change shape when compressed en masse. In cross-section, they "pack" as hexes, then as compression continues become five-sided, then four-sided and three-sided. After this smaller bubbles combine with larger. Metallic grains do much the same thing.

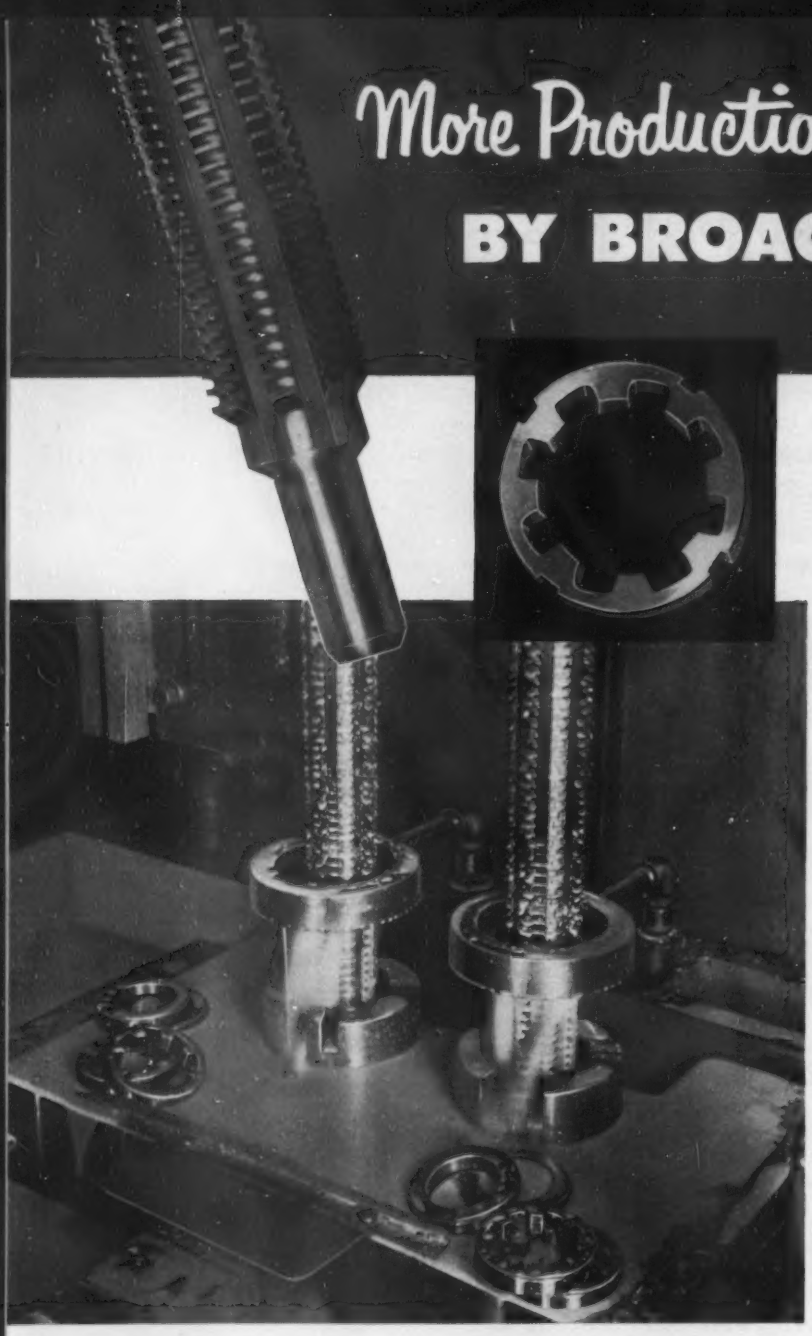
- **WASHER . . .**
  A new washer that assures an average tension preload of 80% of desired bolt preload (with slight deviations) has been developed for more accurate preloading of bolts at Douglas Aircraft. Result: no torque wrenches needed, greater bolt fatigue life, tighter assemblies.

- **JAPAN EYES WORLD METALWORKING MARKETS . . .**
  Japan plans to send a special traveling sales exhibition, accent on machine tools and metal products, to the Middle East — Basrah, Baghdad, Teheran, Damascus, Istanbul, Beirut and Cairo this year. Japan also (1) plans to exhibit at Brazil's International Trade Fair this fall, and (2) to set up a trade center in San Francisco by the end of this year.

- **RIVETS TO WELDS . . .**
  First major automotive supplier to switch from rivets to welds is Motor Wheel Corp, Lansing, Mich, which has spent five years developing its process. Reason: "welded wheels are ideal with the new tubeless tires."

- **NEW TECHNIQUES IN DIE FILM . . .**
  New techniques in the design and fabrication of stamping dies, plus unusual ways of handling stainless steel, beryllium copper and glass-to-metal sealing alloys are revealed in a film that was premiered June 16 by John Volkert Metal Stampings Inc. Film is available to interested firms.

More Production, More Profit BY BROACHING . . .



Internal broaching of a cam ring. The spline form has unsymmetrical sides and cam form on the major diameter. The steel is soft and tends to tear, yet this Continental Broach sizes the I.D. and cuts 8 splines 5/16" deep *in one pass.*

REMOVE STOCK TO PRECISION LIMITS FAST . . . ROUGH AND FINISH IN ONE PASS!

The scope of Broaching has broadened in recent years. Many broaching operations do precision work in far less time than other metal-cutting methods.

Continental Engineers have for years been designing all types of cutting tools, broaches and broaching fixtures. They can recommend the most economical way to do your work.

For facts about increasing your production by broaching, call in your local Ex-Cell-O representative—or write Continental in Detroit for Cutting Tool Catalog.

CTW

Continental TOOL WORKS

DIVISION OF EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

54-15

Washington . . .

Quick tax amortization for new machinery and equipment has been pushed another big step toward adoption. The Senate Finance Committee aproved the version already adopted by the House, and added some ideas of its own. Only an all-out Democratic floor-fight can block adoption, and there's no sign of this yet.

• • •

Used machinery dealers lost a fight to have their products included. The committee said no, after Treasury officials objected to the idea. Their reason: it would cost the Treasury too much money. Officials of the Machinery Dealers National Association, who spearheaded the fight, don't think there's much chance of getting approval on the floor of the Senate. They'll resume their campaign when Congress meets next year.

• • •

Aircraft procurement will pick up late this month and hit a scheduled level in July. The lag in fiscal 1954 — the current year — had mounted to $2½ billions. This recovery follows a general pickup of hard goods buying by the military in the spring months.

• • •

Hard goods buying is now back on a $2-billion per month schedule for all services. Army buying is moving slowly, because there's been no fighting since last year. Aircraft, ships, electronic gear and missiles will receive major attention in the next months.

• • •

You can look for a five-cents an hour wage increase as about the average being given in this year's round of wage negotiations. That's the most common settlement in automobile, heavy machinery, and aircraft industries so far. In most cases, employers are also raising payments to the fringe benefits such as pension, health and vacations.

The big test of the pattern, though, is still to come. That's the contract that's to be signed between the CIO Steelworkers and the United States Steel Co.

• • •

Indo-China has spurred new thinking about government controls on industry. On the materials side, Washington already has priority and allocation authority. Right now, it's used only to channel metals and equipment to defense contractors, and doesn't put much of a squeeze on civilian users because of the easy supply situation. But in event of an emergency, which might tighten up supplies for non-defense consumers, the President is authorized to extend priority and allocation controls to the civilan market. He also has power now to regulate inventories.

Biggest gap in the government's authority to reimpose controls is the matter of prices and wages. Ceilings on these would require Congressional action. But the administration is set with a program. In case of an emergency — full-scale or Korea-type war — the President would ask for an immediate general freeze on prices and wages. He would then leave it to Congress to determine how soft or tough controls should be.

Meanwhile, the President's mobilization planning agency, ODM, is polishing up old OPA-OPS regulations. The agency isn't blueprinting future price controls down to actual ceiling prices that would be imposed. Instead, it's simply ironing out general principles and methods for controls when and if Congress wants them.

There's no truth to talk that the administration now wants standby authority to freeze prices and wages. Last year, Senate Banking Committee chairman Capehart wanted to put such authority on the books. The administration was unenthusiastic, so the Senate voted down the proposal. The administration's stand is unchanged, despite the turn for the worse in Indo-China.

• • •

One-year extension of the reciprocal trade program is now assured. Protectionist Congressmen were set to stall the extension until Congress adjourns. But unexpected action by low-tariff Senate Democrats, who threatened to tack the President's original three-year tariff bill on to the tax bill as an amendment, makes the one-year extension a sure thing. Some Republican high-tariff advocates had been talking about a filibuster to block renewal of the trade bill unless the President promised not to cut any tariffs this year.

• • •

Tariff negotiations with Japan will follow the trade bill's extension. Japan was left out of the big postwar tariff-cutting conferences, and badly needs tariff concessions to boost its faltering export volume. The administration will also try to offer US tariff cuts to other countries who lower their own tariff barriers against Japanese imports. In addition, Washington will push for negotiations this year to bolster the General Agreement on Tariffs and Trade (GATT) — the organization within which all tariff and trade agreements have been negotiated since 1946.

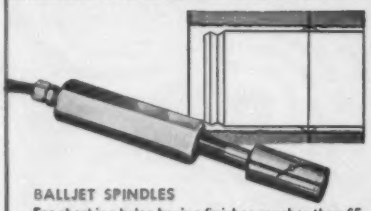
• • •

The Off-Shore Procurement Program — US spending abroad for military hard goods to arm foreign allies — will slow down. (p174) Expenditures over the next year in European nations will be around $300 million, much less than half this year's volume.

Modernize FOR LOW COST PRODUCTION with Newest Developments In Air Gaging

Already these newly developed practical precision tools are helping produce more and better products at lower cost in innumerable plants throughout the world.

Space restrictions here preclude anything more than the briefest description. Phone, wire or write for specifications, prices and delivery—or call the Sheffield sales engineer in your vicinity.



BALLJET SPINDLES

For checking holes having finishes rougher than 65 micro-inches, for porous parts, narrow lands or checking to the very end of a hole. Setting is made with gage blocks and a Standard Calibrator. NO MASTER SETTING RINGS REQUIRED—not even one.

ADJUSTABLE SPINDLE KIT

One, two, three or four spindles may be quickly assembled from components in the kit, for any size between 1 and 3 inches. Gage blocks are used to set for size and to calibrate air gage for amplification.

ADJUSTABLE AIR BORE GAGE

A light, high precision (2,000 to 1 amplification) self-centering bore gage that is easily adjustable from 3" to 12" in diameter, Calibrated by a Standard Calibrator and gage blocks.

AIRETEST INDICATOR

Replaces an indicator where more accuracy and higher amplification are required. Always gives precise readings regardless of the direction of approach. No lag—no gears—nothing to wear out of adjustment. Amplifications up to 5,000 to 1.

AIRELECTRIC HEAD

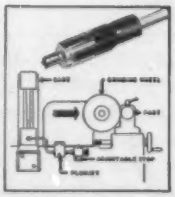
Converts air pressure variations at the gaging contact into electrical impulses which actuate classification and segregation mechanisms or machine control devices. Accurate to a fraction of a "tenth".

ELECTRO-PNEUMATIC UNIT

A self-contained unit of Airelectric Head, indicating dial and signal lights. Easily mounted on the machine to control machine operation by precision measurement of the machined surface. Makes machining automatic. Also used for automatic gaging and segregating.

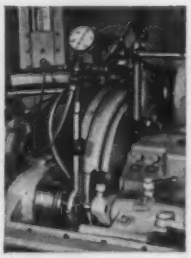
PLUNJET FEED GAGE

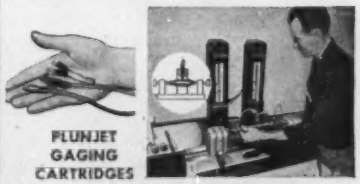
The key element of the machine "Feed Gage" which eliminates error due to feed screw wear. Also, due to the high amplification, makes it easy to manually control the feed to fractional "tenths".



PLUNJET CALIPER TYPE GAGE

Air Gaging Cartridges are used with Caliper Gages for continuous sizing of work on external grinders. Dial is used for approach —PLUNJET brings to final size.





PLUNJET GAGING CARTRIDGES

Precise, low-cost gaging elements which you may incorporate in your own gaging fixtures singly or in multiple to measure practically any dimension or geometrical relationship, with tolerances ranging from .0005 to .100.

GAGE DIVISION, *The Sheffield Corporation*
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SHEFFIELD

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Detroit . . .

Machine tools are having a horsepower race, too. That's the opinion of GE Carboloy General Manager K R Beardslee, who predicts the trend toward higher and higher machine-tool horsepower will become more apparent in the next year or two.

Machine-tool horsepower has more than caught up with carbides, according to Mr Beardslee. But, he warns, "very shortly the picture will change."

His reasoning: new carbide grades now in development will be tougher and capable of making deeper cuts. This will call for machines of higher horsepower and improved design so that carbide tools can operate at the high speeds where they are most efficient.

• • •

Detroit employment, after a nine months' decline, reversed the downtrend in mid-April, when 4000 jobs opened up in Detroit.

But this isn't quite as good as it looks on the surface. Non-manufacturing hiring was responsible for the upswing. Actually, factory work forces were cut 10,000 during the period, but the layoffs weren't as obvious as they might be because of the exodus of the unemployed from the city.

Total Detroit employment at latest count: 1.247 million. Total unemployed: 134,000.

Total Michigan unemployment: 213,000. Total state employment: 2.2 million.

Most depressed city in Michigan is Muskegon, auto parts center, where metalworking layoffs have brought unemployment to nearly 41,000 — 11.4% of the work force.

In spite of the bleak job picture, Detroit auto makers had the fourth biggest first-half production in history with an output of 2.963-million cars. This is 9% under 1953's January-June record of 3.256 million, and 5% under 1950 and 1951 totals.

• • •

With Roger Kyes firmly re-established as a member of the General Motors hierarchy, speculation about his possible future with any other auto company has been squelched. But on the other hand, talk about a realignment of power at GM is gathering steam.

Kyes returned to GM with much more power than when he left it more than a year ago to become Assistant Secretary of Defense.

He formerly headed GM's Truck and Coach Division as a GM vice president. He returns as a group vice president, in charge of GM's Dayton and Household Appliance Divisions, as well as of Truck and Coach.

And he is now a board member, too, serving on the all-important Administration and Operations Policy Committees.

Two other GM vice presidents, Buick's Ivan Wiles and Chevrolet's Thomas Keating were also made members of the Board.

These were the first major executive changes at GM since Harlow Curtice took over some 18 months ago, but they're not likely to be the last by any means.

Three top GM jobs will be vacated soon. Retiring this summer are Harry J Klinger, VP for the car and truck group, and Ronald K Evans, VP for divisions other than automotive and parts. Reaching retirement age next year is Edward R Godfrey, whom Kyes succeeds as head of the Dayton and Household Appliance group. He is now special assistant to Harlow Curtice.

Anyway you look at it, it's more than coincidence that Wiles, Keating and Kyes were upped just before Kliger, Evans and Godfrey retire from top executive posts.

• • •

Have car sales already reached their 1954 peak? Local speculation to that effect is borne out by *Ward's Reports,* which places May sales at 20,000 less than April's 510,000.

Normally, dealer sales campaigns get hotter and hotter as they build toward the traditional peak season deadline — July 4.

But already, with several weeks to go, *Ward's Reports* counted a 21% production decline during the last week in May.

Memorial day had something to do with it, of course, but most of the drop can be traced to lowered output at Dodge, DeSoto, Kaiser-Willys and Pontiac.

Some auto chiefs may be tearing their hair these days, but Buick's Ivan Wiles isn't one of them.

Reason is Buick's spectacular sales pace. Buick sold more than 50,000 cars in May — an all-time high for that month. And May was the third consecutive month in which Buick retail deliveries ran above 50,000 units. Now the Division is aiming for 51,000.

Nash, too, has reason to cheer May sales reports. While not so spectacular as Buick's, Nash recorded an increase of 37.6% over April — making May the best sales month since last August.

Nash's field inventories dropped 17% to the lowest since last November.

• • •

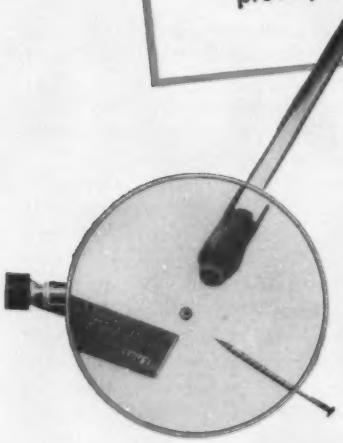
Electronic waker-up for the drowsy driver? A top Ford executive said Ford engineers are exploring ways to detect symptoms of auto drivers' drowsiness with electronics — then warning them it's time to pull off the road.

Ford engineers admit it's being looked into — presumably an adaptation of a similar Air Force device. But they say there's no active program to develop such a gadget.

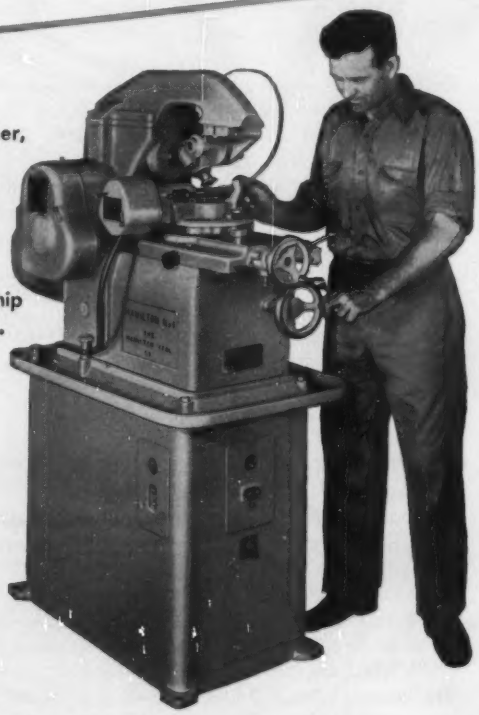
PRECISION GEARS

YOU who use small gears, (to 6" O.D. of the gear blank) can improve the performance of your product, through increased gear precision, without sacrifice of gear production.

YOU who use small, fine pitch, precision gears can increase your gear production without sacrifice of gear accuracy, or improve your gear accuracy without sacrifice of gear production.



The Hamilton Precision Gear Hobber, the hobber with a "reserve of accuracy," regularly holds work spindle and hob spindle runout to less than .0002", workspindle and tailstock spindle alignment to less than .0002", and this workmanship is maintained throughout the machine.



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830 South Ninth Street,
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USE IT WITH CONFIDENCE

Machine Tools . . .

There is some evidence of machine tool buying by the armed services unrelated to the commitment of funds that lapse at the end of the current fiscal year on June 30.

Inquiries are out but actual purchases have not yet been made. The services, on the other hand, are not showing the customary eagerness to rush out and place orders covered by appropriations expiring this month. They apparently intend to let some funds go by default, economy being the watchword.

• • •

None of the money for long lead-time machines will be spent by the Defense Department until Congress passes the defense budget containing the $250 million for that purpose. A similar sum went untouched in the current budget.

Don't count on a lot of federal buying of machine tools the last half of the year, aside from orders for long lead-time machines.

• • •

There is no evidence in Washington of excitement about, or behind-the-scenes preparation for, possible tooling programs that might arise from another Korea in Southeast Asia.

If any military action is pending that would involve stepped-up armament needs, there are no signs of it in Washington, including the Pentagon.

• • •

There may well be a delay of either weeks or months in revising present lists of machine tools that are forbidden to be shipped behind the iron curtain. A thick veil of secrecy has been thrown around the matter. Federal officials have been cautioned not to talk.

But the fact is becoming obvious that the pressure for haste in preparing a new strategic list and putting it into effect has eased.

• • •

A "wait-and-see" policy seems to be in the making. What will the Geneva talks bring, if anything? What's going to happen in Indo-China? Until some of these questions are answered, the lifting of the ban on certain types of machine tools for shipment to Russia is not likely.

This attitude, incidentally, represents a shift in earlier thinking. Official talks in London and Paris were to have been followed by conclusive action around July 1 or shortly thereafter.

• • •

Chances are very slim for the British to be able to fill any sizable proportion of the orders on hand from Russia, as long as the strategic list is not revised.

Applications for export licenses from British machine tool builders and their agents for shipment to Russia amounted to $85 million the past six months.

This figure does not include tentative approaches to the Board in which no cash value was mentioned.

The business in question is for shipment the next 5-6 years and not immediately. Out of 216 applications for licenses, only 61 have been allowed, involving machines worth $6.1 million. Some 52 applications totaling $4.7 million do not need approval. Remaining 154 applications have been filed for later action.

• • •

As a machine tool show, the seventh Canadian International Trade Fair at Toronto (May 31-June 11) fell just a little short of last year's spectacular exhibition.

Very little brand-new equipment was on display. Almost all the machines on the stands had been seen at other shows. Many of them were the same type of machines exhibited at the 1953 Fair.

Machine tool displays occupied less space this year than last.

• • •

26 Italian machine tool companies showed some 35 machines at the Fair. Germany had twice the space of any other Continental European country in the Machine Tool Section. It also maintained a Trade Information Center on machinery.

The British had considerably more space at the Fair than the Germans. In fact, they were second only to Canadian builders and distributors.

Swedish companies took a fair amount of space, but partly to show woodworking machines.

Association of French Machine Tool Manufacturers had 10 exhibits. Belgian builders also had several machines on display.

Only a handful of US builders showed their machines.

• • •

Prevailing sentiment among builders and distributor was that the Fair should not be held annually.

Canadian dealers vow that they did not put the heat on any builders that they represent to participate in the Fair.

Not all Canadian machine tool builders were represented at the Fair.

• • •

Daily attendance was light. The recent ASTE Show at Philadelphia is believed to have hurt. The Fair-every-year program hurt too. Many exhibitors complain that the Fair is spread over too long a time (two weeks).

For further details about the Canadian Fair, please turn to page 166.

way back in 1941 the LeBlond RT Lathe

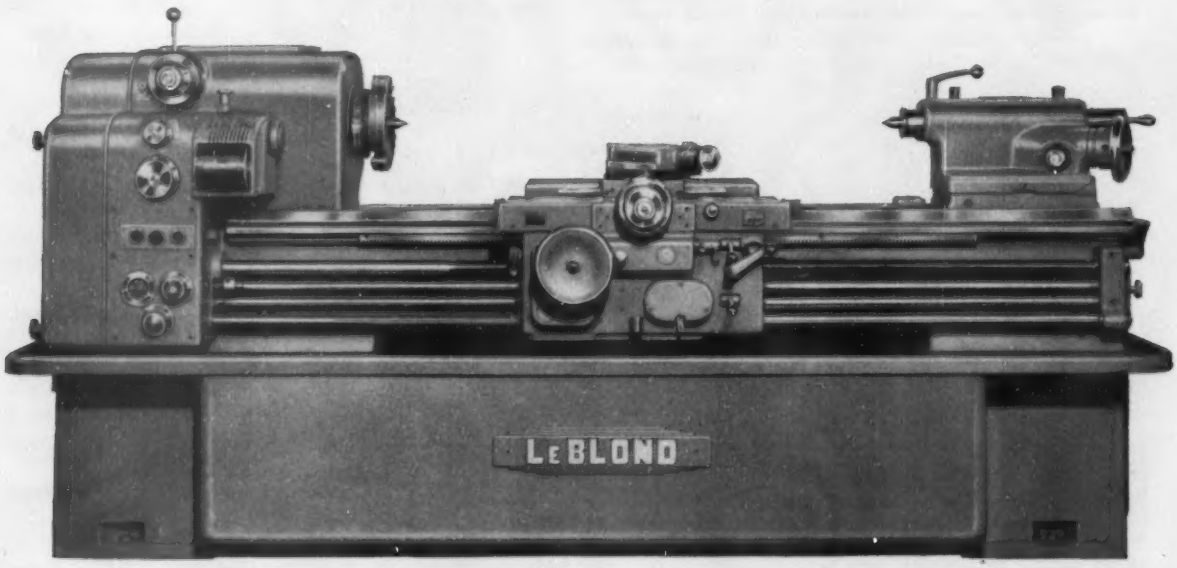
13 years ago, LeBlond's RT Tool Room Lathe with these major

Satin-smooth Power Rapid Traverse to the carriage and cross slide plus pick-up traverse to the tailstock. No jerking, jolting or jumping. Gives you the most in operator convenience as an integral part of the apron. First developed by LeBlond in 1935.

Automatically Positioned Leadscrew and Rod Supports perfected in 1923.

A Universal Quick-change Box with 90 feeds and threads in two ranges. You can cut from 120 threads to 1/4 thread per inch — without setting pick-off gears, mounting a sub-head or using any other attachment. Diametral pitch threads, leads in inches, millimeter leads and module pitch leads also can be cut by making a slight gear change. Put into production by LeBlond in 1937.

Automatic Chasing Stop, used primarily for cutting threads, limits cross slide travel positively and accurately. Makes possible speedy chasing, since cross and length power rapid traverse can be used to bring cross slide quickly back to exact starting position for each pass.



Condensed RT Lathe Specifications:

Swing over bed and carriage wings	18½"
Swing over compound rest	11½"
Distance between centers, base length	30"
Spindle speeds, range, rpm	
Low back gear	6 to 60
High back gear	30 to 300
Direct belt drive	150 to 1500
Feed and thread changes	60 regular 30 coarse
Feeds, range	.0007-2.064 ipr
Threads per inch, range	2 - 120 regular ¼ - 1⅞ coarse
Floor space required	96" x 48"

had today's Most Wanted Features

advancements set the standard for lathes today.

RT Combined Feed Apron with built-in Taper Attachment achieved in 1939. Cuts gradual or steep tapers with the larger dimension either towards the tailstock or headstock—without special machine set-ups.

An Exclusive Off-set Handwheel Tailstock employing a worm-and-rack construction for positive-position locking, greater operator convenience plus Hollow Tailstock Spindle adaptability. Equipped with a direct-reading spindle travel indicator.

And in 1946, the ***Variable-voltage Speed Control*** was incorporated into the head to provide over 300 spindle speeds in three ranges controlled by a single lever.

After five years in development and four years of on-the-job testing in LeBlond's production line, Industry met for the first time the 16" RT Tool Room Lathe at the 1947 National Machine Tool Show. There the RT's spectacular features—far ahead of their time—caused a flurry of comment about its amazing versatility. This lathe could do almost anything.

Only within the last few years have tool engineers throughout the lathe industry built into their lathes those features of the LeBlond RT Lathe that were "new" back in 1935 . . . in 1937 . . . in 1941 . . . in 1946. Features that made the RT Lathe famous for the ability to handle almost any job without time-wasting special machine set-ups. Even in 1947, there were many who felt their tool room requirements were not varied enough for them to take full advantage of the RT's vast potential.

By adopting those early RT features on their current models, lathe makers acknowledge the greatness of LeBlond's RT Tool Room Lathe, conceived *almost 18 years ago.*

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

For a detailed description of the LeBlond 16" RT Tool Room Lathe and the lower-priced 16", 16-speed RT Engine Lathe, send for Bulletins RT-31 A and HD-31. A.

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LEBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES—FOR OVER 64 YEARS.

SLUDGE? NO
RUST? NO
FOAM? NO

WHEN YOUR hydraulic medium is *Texaco Regal Oil R&O*, you've got the world's finest protection against rust, sludge and foam. As one user (name on request) says, after years of using it —

"I have yet to see one of our units in which *Texaco Regal Oil R&O* has been used that wasn't clean, free from rust and sludge — with pump parts, piping, controls all in A-1 condition."

Tests prove that *Texaco Regal Oil R&O has more than ten times the oxidation resistance* of ordinary turbine-quality hydraulic oil. It is far superior in preventing sludge, rust and foam. There is a complete line of *Texaco Regal Oils R&O* to meet every hydraulic requirement.

A Texaco Lubrication Engineer will gladly work with you to increase efficiency and reduce costs throughout your plant. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Regal Oils R&O

FOR ALL HYDRAULIC UNITS

Gaging Metalworking . . .

PRODUCTION INDEX
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	MAY '54(*)	APR '54(p)	MAR '54(r)	APR '53
Tot. Index...	143	147	147	169
Machinery	125	126	147	
Electrical Machinery	166	163	195	
Autos	121	116	135	
Other Transportation	267	267	286	
Other Metalworking	122	123	141	

(*) Estimated (p) preliminary (r) revised

Don't expect a pickup in Metalworking this summer. Don't look, on the other hand, for a sharp drop. Operations probably will hover close to the present level. The best that one can anticipate is that the production curve will go sidewise.

One must make allowances, of course, for vacation shutdowns. They will be wholesale around the industry, with many plants closed up tight for two-week stretches.

• • •

Steel mills say that June has been a fair month by today's standards. June was a little ahead of May in bookings, and May in turn was better than April.

A modest amount of tonnage is being put on rolling mill schedules as a strike hedge, but in the aggregate it really isn't much. There would have been a pickup in steel sales without a strike threat.

Automotive buying of steel is described as "pretty good" but is puny compared with not so long ago. Motor car makers are keeping stocks down and don't want to accumulate much steel.

• • •

Industrial machinery builders continue to produce at a relatively high rate, but soon must taper production unless they receive more orders.

Contract tool and die makers expect that business will level off during the third and fourth quarters. January was apparently the lowest spot in several years. Since then, things have looked up somewhat, but not enough to cause loud cheers.

The post-Korean boom in tools and dies has mostly spent itself. Certain plants still are working as long as 50 hours a week, but the industry is averaging not much better than 40 hours. Almost all shops are on a single-shift basis.

Backlogs range from two weeks to six months, depending on the article being turned out. Defense orders have shrunk to a small volume.

• • •

Stamping plants report sales off 25% from the base period 1947-1949, and down 20% from 1953.

Biggest decline in stamping business is from the automobile industry. It is off 30% from 1953.

Work on hand in the stamping industry adds up to about 10 weeks on automotive orders, 20 weeks on military business.

• • •

Metalworking will stay about where it is during the third quarter, the Pacific Coast reports.

It is going along at around 10% below last year's peak, a very healthy condition. It has been at this level all year.

Big surges of order-taking, common in 1953, are conspicuously absent this year. And that is a good thing, because it makes for a more stable production rate and more easily controlled inventories. "We're eliminating the leaps and bounds," is one comment.

Backlogs, in general, are small, inventories are down, and sales have picked up but a summer dip is anticipated.

Industries heretofore dependent upon government business are actively adjusting to the new situation.

One aircraft components maker, to cite a case, predicts that his present defense work will be trimmed back from a current 97% to 75% by the year's end. He is looking for civilian orders as a replacement.

Gaging Business . . .

PRICE INDEX

	JUNE '54(*)	MAY '54(p)	APR '54(r)	MAY '53
Total Index	**132.4**	**132.5**	**132.6**	**130.4**
Metalworking Machinery	**141.6**	**141.6**	**138.9**	
Other Machinery exc. Electrical	**137.5**	**137.5**	**134.3**	
Electrical Machinery	**131.2**	**131.7**	**127.6**	
Fabricated Metal Products	**128.8**	**128.9**	**127.6**	

(*) Estimated (p) preliminary (r) revised

Both the optimists and the pessimists can find something to chew over in the recent and the current unemployment situation.

On the optimistic side: 160,000 fewer people were without jobs in May than in April, for a total of 3.3-million unemployed. But this decrease is seasonal.

Also on the bright side: new claims for unemployment compensation filed in May were the lowest for the year — indicating some easing up in the industrial lay-off rate.

• • •

But on the pessimistic side, it looks like June unemployment figures will show a sharp increase because of the influx of students into the job market.

And July may see 4-million people out of work in the United States.

Also on the dark side: 16 more industrial areas have been placed in the substantial labor surplus category (distress areas).

Of the 149 areas reporting in, 133 have a labor surplus, 16 a balanced labor supply. None reports a labor shortage.

• • •

Commerce Dept's check of capital spending plans taken in May shows the annual rate of plant and equipment outlays for all business in the second quarter hit $26.9 billion.

And it is expected this rate won't change much in the third quarter.

Continued high capital spending rate shows businessmen have confidence in future sales.

• • •

Total consumer credit, covering both installment and non-installment buying, amounted to $27.3 billion at April's end — $875 million above April 1953.

Of this, $20.9 billion was installment credit — $1.1 billion higher than a year ago — a reversal of the installment downtrend during the last few months.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100) *	124.2	124.3	131.2
Steel ingot operations (thousands of tons)	1,740	1,674	2,208
Electric power output (million Kilowatt hours)	8,246	8,433	8,096
Production of automobiles and trucks	120,606	148,744	134,619
Engineering construction awards (*Eng. News-Record* — millions)	$325.5	$204.4	$368.7

QUARTERLY BUSINESS INDICATORS

	Latest Quarter	Preceding Quarter	Year Ago
Gross National Product (billions)	$357.8	$363.5	$363.9
Expenditures of new plant and equipment (billions)	26.9	27.5	27.2
Profits after taxes in primary iron and steel industry (millions)	205	236	257
Profits after taxes electrical machinery industry (millions)	163	159	212
Profits after taxes machinery (except electrical) (millions)	184	210	243
Profits after taxes in motor vehicles and parts industry (millions)	233	236	278
Motors and generators new orders index (1947-49 = 100)	144.6	171.3	157.8

* Seasonally adjusted.

Save labor...

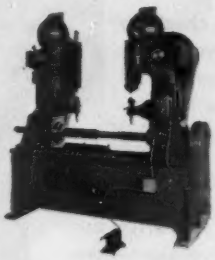
cut costs with

FASTER Riveting and Clinching!

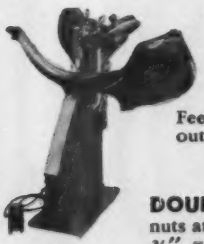
T-J

RIVITORS

T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembling, setting, inspecting and ejecting.

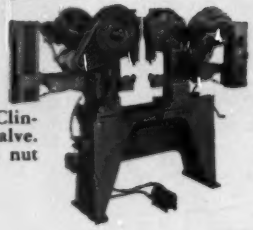


DOUBLE RIVITOR sets two rivets at a time! Equipped with 10" hoppers, and tooled to automatically feed and set two ¼" dia. x ⅝" long wagon box head rivets at a time in elevator chain and raddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.



CLINCHORS

T-J CLINCHOR . . . one of six special 8" throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets 11/16" square cased nuts in outside quarter panels, left and right hand.



DOUBLE CLINCHOR sets two nuts at once! Tooled to feed and set ⅜" x ½" x 1/16" thick Fabri-Steel nuts at each operation. Both Clinchors tripped by same foot-operated valve. Adaptable to wide range of clinch nut setting problems.

Automatic Feeding and Setting

T-J meets your needs for labor-saving SPEED in assembly . . . with performance-proved Rivitors and Clinchors for many jobs today...in aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal! Available in Underfeed and Gravity feed models, throat depths 8" to 36".

T-J RIVITORS automatically feed and set solid rivets . . . with high production! Electrically powered Rivitor sets 1/16" to ¼" diam. solid steel rivets up to ⅞" long. Air-powered Rivitor sets aluminum alloy rivets up to ¼" diam. or steel rivets up to ⅛" diam. and up to ¾" long. Throat depths 8" to 36".

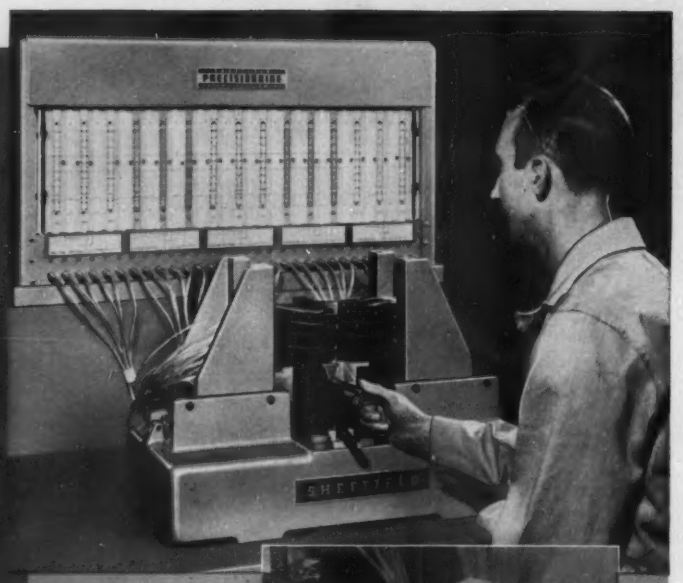
Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson, Mich.

37 YEARS EXPERIENCE T-J

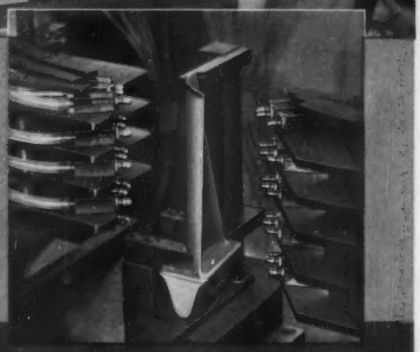
TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

YOU CAN GAGE 40 or MORE DIMENSIONS *As Quickly* AS YOU CAN ONE



Checking 30 points on a jet engine blade



Gaging heads ready to approach the jet engine blade

Spectacular developments in AIR gaging are saving industry millions of dollars and thousands of man-hours. Here's how and why:

1. One operator with one gage can check up to 40 or more dimensions of each work part simultaneously and instantly. The number of parts per hour depends solely on how fast the inspector can handle them.

2. Precision is built into the gage—readings are unaffected by human skill, human judgment and human memory. It's not necessary to memorize and compare readings for individual dimensions—one quick panoramic glance at the float pattern ("Airechart") tells the whole story—the "Float Graph" shows the true condition of every critical dimension.

3. The position of each float shows just where the dimension is within tolerance limits or just how much above or below limit if it is out of tolerance. This is essential for Quality Control.

PHONE, WIRE or WRITE for the full story on how YOU can "produce more and better products at lower cost through practical precision"—in this case, multiple dimension inspection by Precisionaire gaging.

Gage Division — The Sheffield Corporation
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All main bearings of a tractor crankshaft are checked simultaneously

6757

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Replacement—Market with a Future

Our economic seers love to put on their rose-colored glasses and take a look at the 1960's.

Peering into the future, they see tens of millions more Americans than today who are going to have to be fed, clothed and housed. Their eyes sparkle and they lick their lips as they think in terms of the annual market then for automobiles, refrigerators, ranges, schools and a thousand other items.

No one seriously doubts that these delightful predictions will come true. All the known factors support the theory.

At the same time, no one has bothered to try to translate these stimulating developments into demand for capital goods, and specifically for production equipment.

If our human population is to grow so spectacularly, and our needs thus are to be expanded, our machine population is bound to increase too. In 1949, some 1,762,000 machine tools were installed in the US metalworking industries. Four years later, the total had gone up to 1,941,000, a gain of 9%.

What will be the total of machine tools in 1960? In 1965? In 1975?

These questions come to mind as the result of a provocative study of replacement requirements for capital equipment made recently by the Machinery and Allied Products Institute. Capital equipment is used in the broad sense, as MAPI defines it. It includes machinery and component parts, plant and industrial equipment, and transportation equipment.

MAPI points out that the stock of capital equipment has an historic growth rate of about 3% per year compounded. More than that, four-fifths of the replacements of capital equipment occur in the over-10-years-of-age bracket.

If this rate of growth continues unabated, and there is no reason to believe that it won't, the stock of capital goods over 10 years old will rise from $60 billion at present to $100 billion in 1960, and to almost $200 billion in 1975.

This means that the amount of "over-age" capital equipment installed in US industry 21 years from now will be more than three times the amount today.

Analysis of data from American Machinist's 1953 Inventory of Metalworking Production Equipment supports the theory that the sheer volume of over-age machine tools will balloon in the coming years. Last year the nation's metalworking shops contained more machine tools 10 years old or older than there were machine tools of all kinds and ages in 1940, just before our involvement in World War II. What reason is there to doubt that the over-age total will go up some more the next 10 to 20 years?

All of which leads MAPI to compute replacement requirements for capital equipment at $10.4 billion in 1954, rising to $15 billion in 1960. As for 1975, requirements then will be at a $26.7 billion level.

Thus the long-range outlook for capital goods is excellent. The statistics support the forecast of a constantly mounting equipment replacement demand.

That constitutes the best kind of news for builders of production equipment. It does not signify that business will be continuously good; nor does it guarantee that every builder will share equally well. It means that the builder who keeps his designs up-to-date, who properly engineers his product, and who does an intelligent, aggressive, selling job, should look with confidence upon the future.

Beyond that, don't overlook the fact that whenever capital goods are moving, the economy usually is in good shape and the nation is prosperous.

Burnham Finney

EASTON simplified production

and improved product with this

CINCINNATI
Press Brake

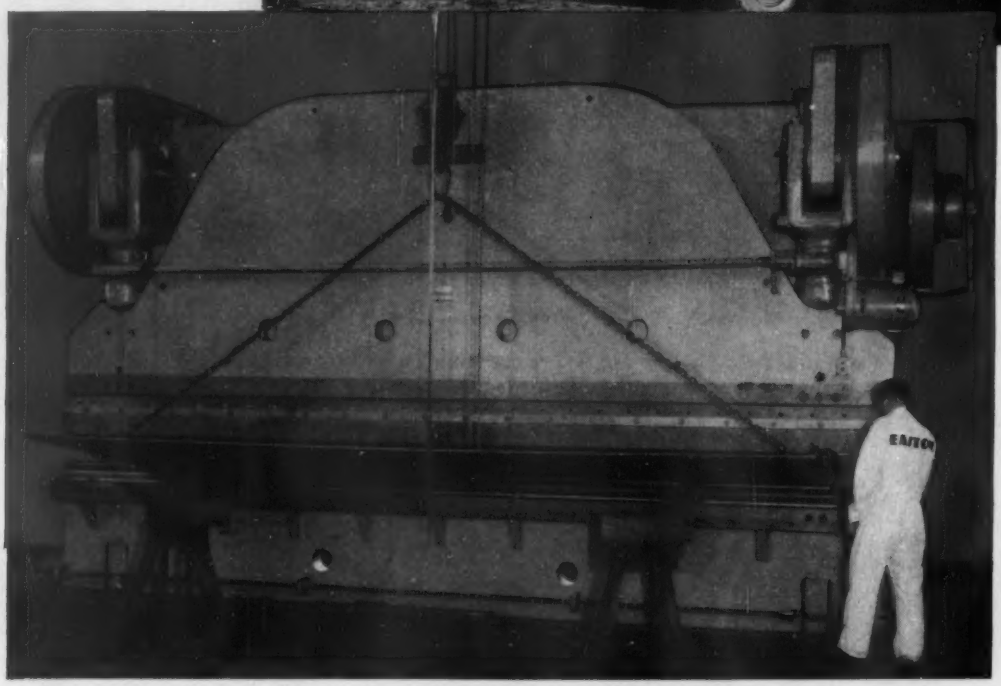

Illustration courtesy Easton Car & Construction Company, Easton, Pennsylvania.

Here a Cincinnati Press Brake is forming ½" plate for wide sections of off-highway trailers, at the Easton Car & Construction Company, makers of a large line of products for industrial transportation.

By using this Cincinnati Press Brake, some welding operations were eliminated, which improved the product, and reduced production costs at the same time.

The power, accuracy, and versatility of Cincinnati Press Brakes are reducing manufacturing costs where ever they are installed. If you form, or bend, you should investigate their possibilities.

Write for Press Brake Catalog B-4.

CINCINNATI

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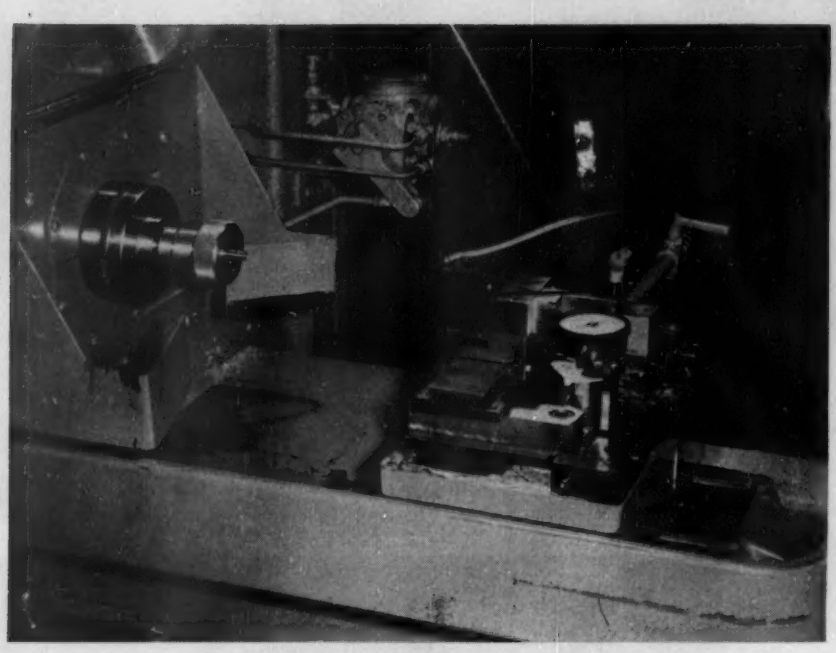
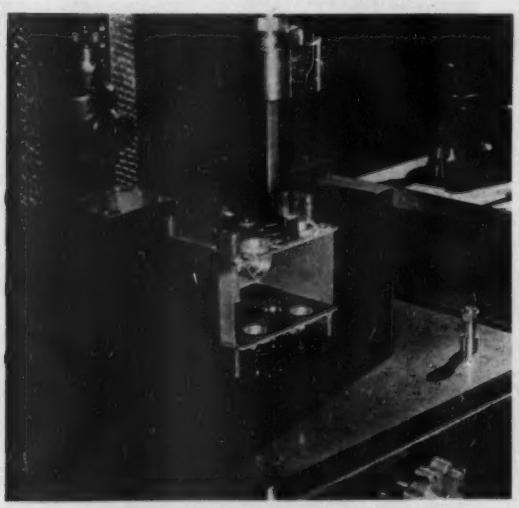


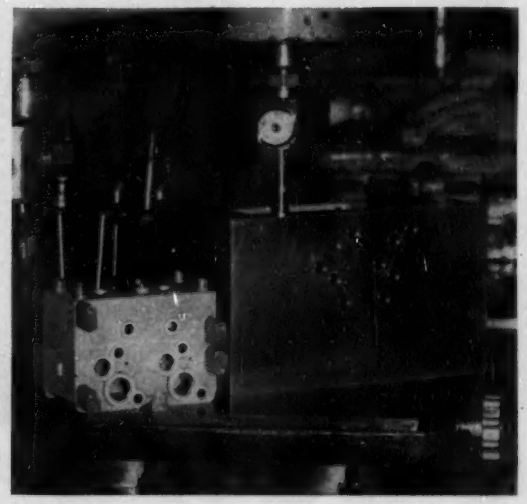
BENCH-LATHE COMPOUND accurately mounted on table of Heald Boremaric permits boring small shaft concentric within 0.0002 in. Boring tool is setscrewed in toolholder and work is held in split-nest mounted on machine spindle, which turns at 5500 rpm. Coolant is fed to tool through flexible metal hose

Production tools for precision

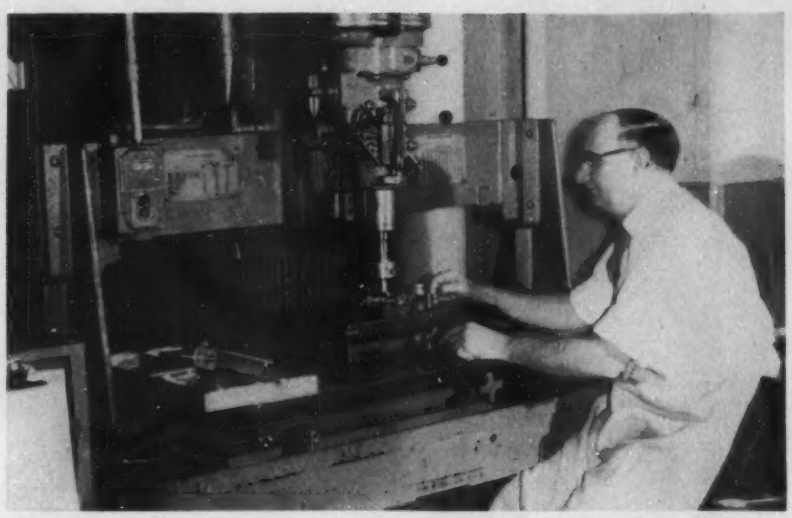
Ford Instrument Company (Div of The Sperry Corp), Long Island City, NY, has set up a special shop to manufacture its ingenious, and complex, automatic avigation computer. Here, in pictures with captions, is some of the tooling developed to provide components in quantity and tolerances in "tenths."

WM M STOCKER, JR, associate editor

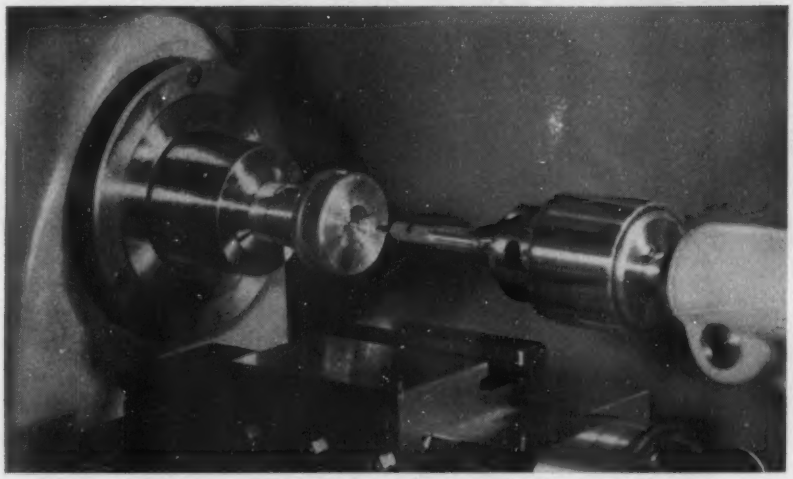




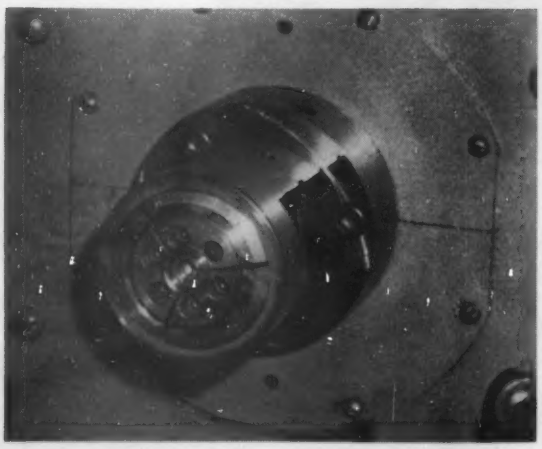
MASTER PLATE FOR JIG BORING allows repetitive close-tolerance boring with rapid setup. Fixture contains hardened and ground bushings to correspond with all of the hole locations in the workpiece. When knob on baseplate is turned, locating pin emerges to engage bushing; thus align hole for boring



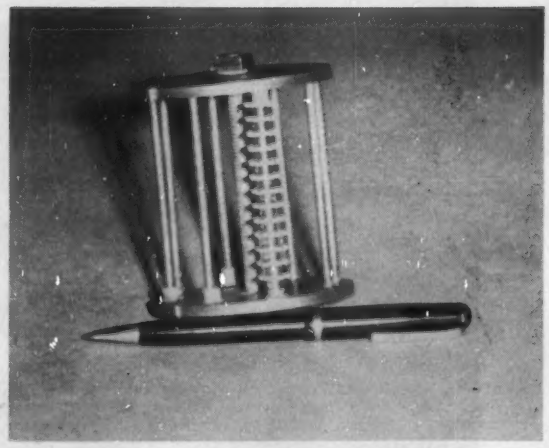
HOMEMADE JIG BORER consists of bridge from discarded printing press, table from cam profiler, and specially cast legs. Bridgeport milling head was modified with improved clutch. Broad work surface plus excellent rigidity make this machine interchangeable with standard jig borers for master-plate boring



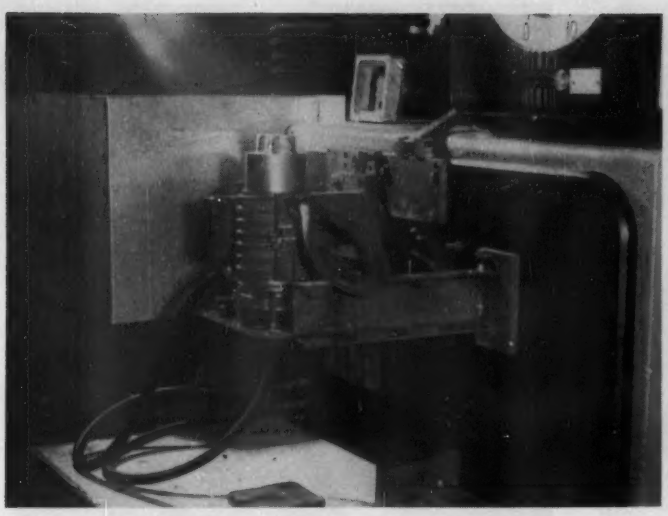
BRASS COLLET on Hardinge bench lathe is held in conventional collet. Threaded, split, and equipped with a knurled and threaded collar, it is readily rebored for each new piece shape

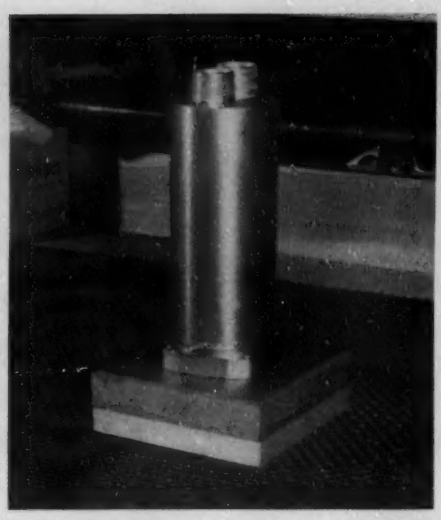


AIR-OPERATED CHUCK on Borematic speeds loading and unloading of work. Chuck-jaw adapter is machined, hardened, and ground to nest specific part. Latter is turned and bored, with bore and external faces concentric within 0.0002 in.

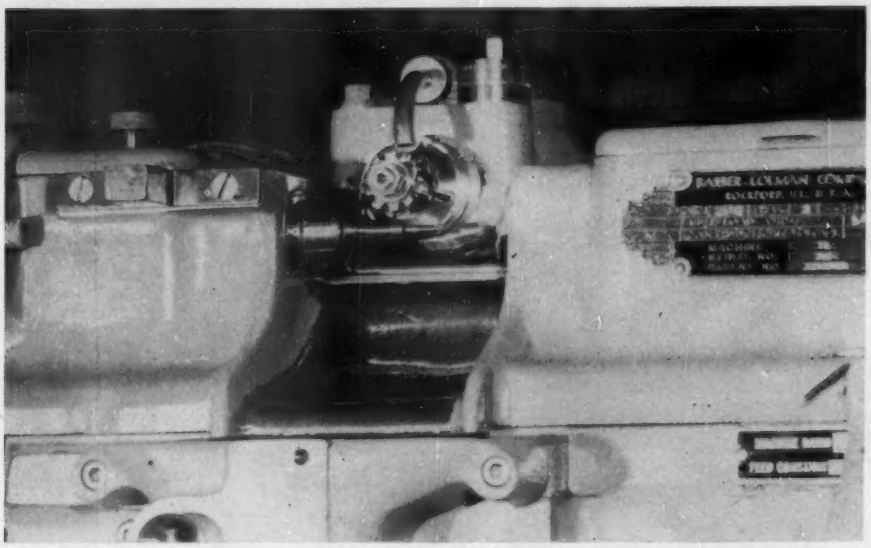


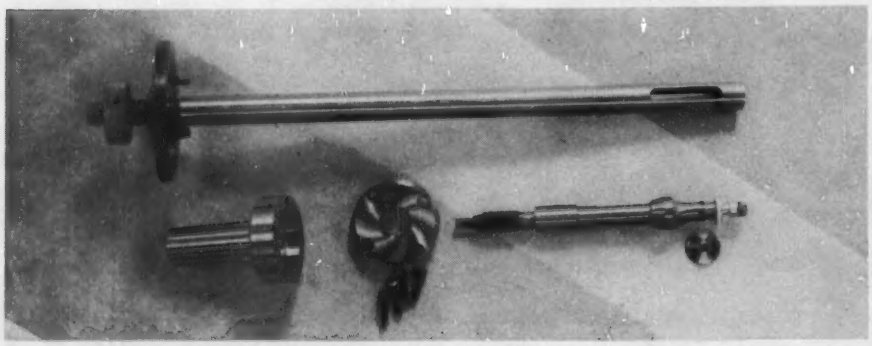
BARREL FINISHING of small precision gears is made possible by this simple fixture. Gears are placed on pins supported between two round plates and clamped with a threaded stud and a nut. This method eliminates hours of tedious bench work; produces a clean, burr-free gear. Without the fixture, gears would be damaged in the barrel and difficult to separate from the abrasive





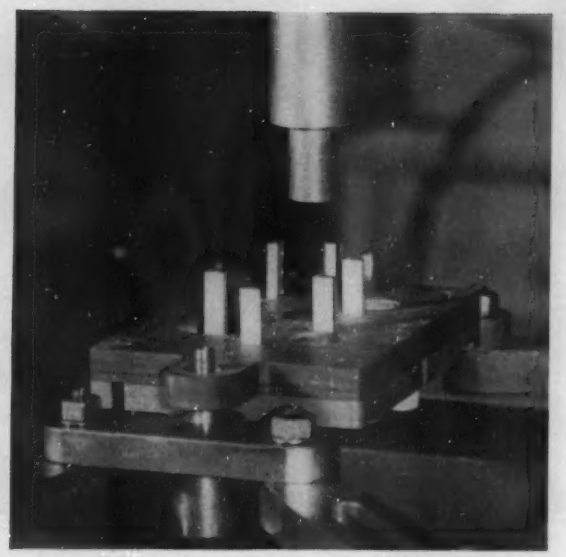
INDUCTION SOLDERING, with 60-40 soft solder, is necessary to hermetically seal the computer case. Soldering is made possible by first nickel plating the aluminum (AM—June 7 '54, p154). After plating, the nickeled areas can be soldered. The 18 kva induction unit operates at 400 kilocycles and 5 3-sec heating cycles are required to complete the joint. Continuous heating would damage the computer mechanism within the case, which is also prevented from overheating by the water-cooled jacket. The latter is flushed with 6 gal. of distilled water per min. and city water is used in a heat exchanger which cools the recirculated distilled water. A clock and thermostat shut off all power if heat accumulates beyond 500 F in critical areas



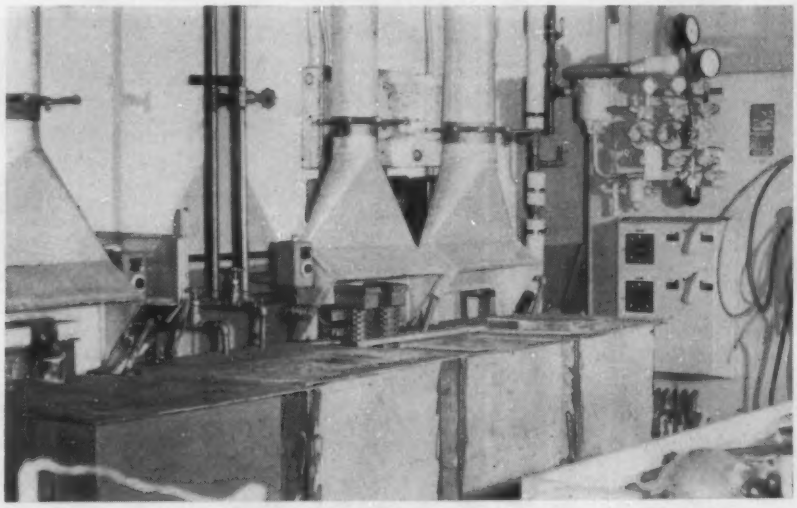


MINIATURE GEARS ARE CUT within 0.0003-in. total indicator reading by using a two-piece adapter which assembles to the machine arbor with a drawscrew. Split adapter can be shifted (front plate) to correct for eccentricity, then tightened. Gear blanks come from Borematic within 0.0002 in. (Collet closers also are made with this aligning provision.)

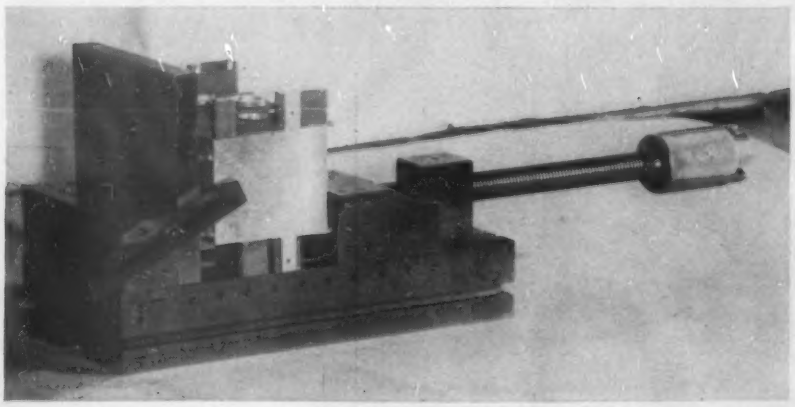
PROJECTION-WELDING ALUMINUM is practical but requires special care. After thorough cleaning of the parts, operator must move rapidly to avoid contamination. Shown here, left to right, are Taylor-Winfield 100 kva resistance welder, operator, tensile tester, and jig storage bench. Welder cycle is critical



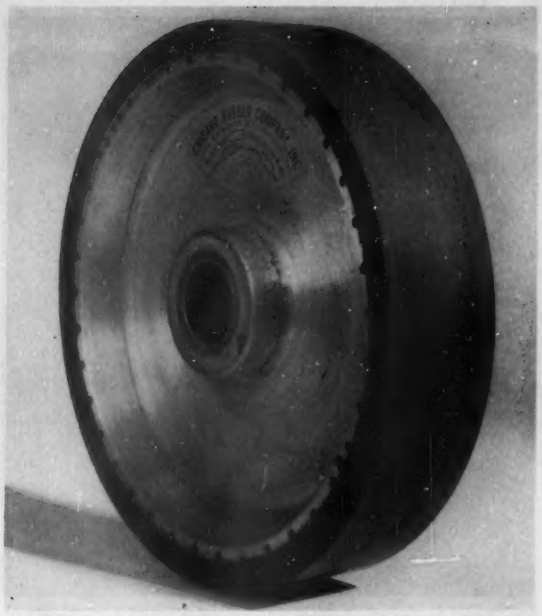
FIXTURE FOR PROJECTION WELDING is fiber-base phenolic resin; holds parts in place on steel master-plate with die-set accuracy. Part shown is plate weldment on which six studs are positioned within 0.0002 in. of each other. Weld strength is excellent



CLEANING is an extremely important step in the preparation of aluminum for projection welding. Here, to the left of the welder, are the tanks used for the four stages of washing. First, Clepo 85P for 15 min.; then, hot- and cold-water rinse; next, Clepo 180 for 12 min.; and finally a cold-water rinse. First pieces are tensile tested after welding and, if result is poor, the cleaning cycle is repeated



PRECISION VISE designed and built by Ford toolmakers is accurate within 0.0001 in. in any direction; cost is high. However, vise saves countless hours in setup and inspection, especially on close-tolerance, one-of-a-kind, pieces



FLAT-FACED RUBBER CONTACT WHEEL serves for general belt polishing and grinding. Hardness of the rubber controls the degree of finish and metal-removal rate. Harder grades remove stock faster but give poorer surface finish

COG-TOOTH RUBBER WHEEL increases belt cutting action and gives longer belt life. Width and shape of lands and grooves, plus hardness of rubber, control the cutting action. This type is commonly used for stock removal

Contact wheels influence abrasive-belt performance

Don't expect to use the same contact wheel for all coated abrasive-belt grinding and polishing operations. Different types and materials can profoundly affect the stock-removal rate and finish obtained

DIRCK OLTON, manager products engrg dep't, BEHR-MANNING CORP., TROY, N Y

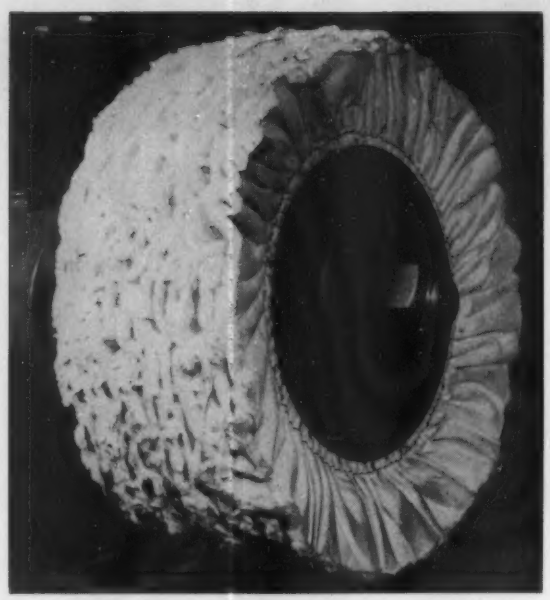
To gain full advantage of the roughing and polishing characteristics offered by coated abrasive belts, the contact wheels which back up the belt must be carefully selected. This is especially true in offhand roughing and polishing, where manual pressures and part-positioning vary constantly and are altered according to immediate working requirements. Some jobs call for heavy stock removal, such as removing flash and risers from castings, while others may require careful polishing, such as finishing the convex surface of a thin metal stamping.

Coated abrasive belts will do both jobs well but, to get the best performance, the specific contact wheel should be selected according to material and hardness best suited to the particular job to be done.

Commercially available contact wheels for offhand polishing are generally manufactured from rubber or cloth. Rubber contact wheels consist of solid tires vulcanized to aluminum wheels, or to metal rims which can be mounted on hubs to form wheels. They have gained favor with belt users in recent years because improved methods of bonding the rubber to the metal have been developed, and rubber density can be more closely controlled than previously possible. Both plain- and serrated-face designs are available, each serving a specific purpose.

Plain-face wheels are manufactured from rubber of densities ranging from extremely soft (Durometer

COMPRESSED-CANVAS WHEELS are built of rectangular sections arranged radially. In a wheel of medium density, sections can be separated with the fingers. Hard wheels are so tightly compressed that they cannot be so separated



FULL-DISK CONTACT WHEELS consist of stitched canvas disks assembled into sections from ¼ to ½ in. thick and held on the spindle between flanges. Wheel width can be adjusted by adding or removing sections

10-20), to extremely hard (Durometer 90). Extremely soft wheels are made of sponge rubber and are used for fine polishing on metal and for contour polishing. The next density rating, soft wheels (Durometer 20-30), are made of solid rubber and are also used for polishing and contour grinding. Medium-density wheels (Durometer 30-60) are used for normal polishing operations where a reasonable finish is required in producing a polished surface, and removing some metal, but as the density of the wheel is increased the cutting action of the belt is increased, and the finish becomes coarser.

Serrated rubber wheels have grooves milled into the wheel face to increase the cutting action of the belt and prolong belt life. One of the most common of these is the "cog-tooth" type.

The effect the contact wheel has on the cutting action of the abrasive belt depends largely on the width and shape of the land, the width of the groove, and the hardness of the rubber. The cog-tooth design is cut with a 3/16-in. land and a ½-in. groove for maximum cut. Aside from producing a cooling action, the widely spaced serrations in the cog-tooth wheel force the abrasive belt into the work. Maximum grain penetration into the work produces full cutting action of the belt. This type can be of one-piece construction, or a rim held between flanges.

Densities of rubber in serrated wheels range from soft (Durometer 20) to hard (Durometer 90); in the cog-tooth design from 50 to 90 Durometer. Soft serrated wheels can be used for the same type of work as plain-faced rubber wheels of the same density, but will remove stock faster and produce a slightly inferior finish on the work. As density is increased, the belt shows more aggressive cutting action but the finish is poorer. Cog-tooth wheels are usually used for stock-removal jobs.

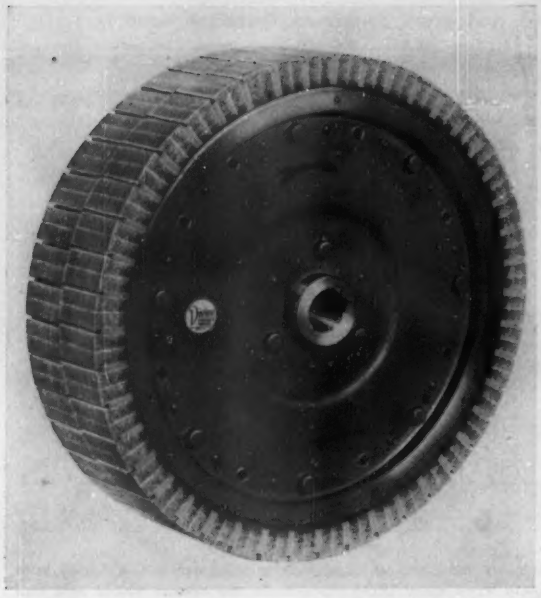
CLOTH CONTACT WHEELS

Cloth contact wheels are manufactured in two general types: compressed canvas, and full disk, or bias buff. The compressed-canvas wheel was one of the first types and is still extremely popular. Designed originally for setup polishing wheels, it was found to be well adapted to support coated abrasive belts. Made of rectangular sections of canvas mounted radially between riveted metal flanges and a steel hub, it is ideally suited for abrasive belt use because of its uniform density, balance and concentricity. These two factors are particularly critical. Wheels are dynamically balanced by the manufacturer and, unless damaged, remain in balance.

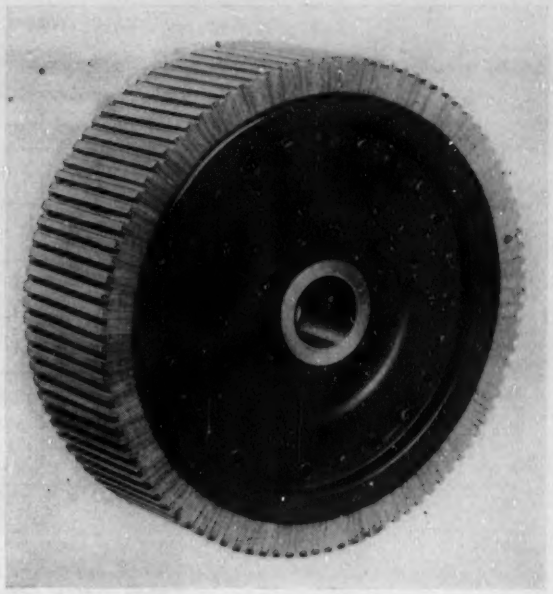
Although compressed-canvas wheels are available in nine densities, three (hard, medium, and soft) are most popular. Specific recommendations are difficult to make because so many variables are involved but, in general, hard wheels are used for roughing, softer for fining and oil-fining.

Full-disk contact wheels are composed of disks of canvas sewn together into sections ¼ to ½ in. wide. Several such disks are mounted side by side on the polishing-jack spindle between a pair of bell-shaped steel flanges to form a wheel. Width of the wheel can be adjusted by adding or removing sections.

Hardness can be increased by using bell flanges of greater diameter. However, these must always be smaller than the diameter of the disk sections. Increased belt tension and higher speed will also in-



HEAVY-DUTY CONTACT WHEEL has a rim of laminated rubber and fibre and is designed for high-speed stock removal of gates, risers, welds, parting lines, and other relatively rough, heavy work



SLOTTED, COMPRESSED CANVAS WHEEL for heavy stock removal at 4500 to 7500 sfpm. Straight slots provide maximum stock removal, but are extremely noisy. For quieter operation, but slightly slower cutting, slots should be at an angle

crease wheel hardness. To increase the resiliency, spacers can be placed between the buff sections.

If a cloth wheel of a specified diameter and face width is desired, such a wheel can be purchased. It is made of buff sections sewn or glued together and mounted on a metal bushing.

Full-disk cloth contact wheels are often used for contour polishing. They yield readily to pressure and will conform easily to the shape of curved work.

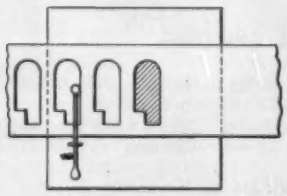
Many times a contact wheel must be especially designed for a specific job. Variations in design range from changes in composition to special widths and shaped rims, and special shapes can be factory formed to a customer's templet or workpiece, usually from compressed canvas.

The characteristics of a contact wheel change with variations in operating speed. For instance, a soft contact wheel will "harden up" or present a more solid support for a coated abrasive belt as its speed is increased. For this reason, increasing belt speed will not result in speedier output of work. The belt will not conform to contours as easily and will not necessarily grind faster.

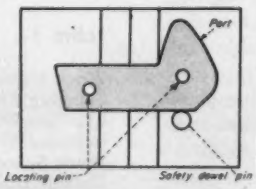
Belt speed is determined largely by work material, thickness of the part, and type of job to be done. Size of the wheel depends on shape of the part.

Diemakers' Kinks . . .

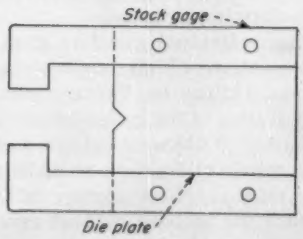
FEDERICO STRASSER



AUTOMATIC STOPS of the trigger type are not suitable when the stock is ⅛ in. thick or more, because of crowding by metal flow. If a trigger stop must be used, locate it to engage the second opening in the strip from the blanking aperature.



IRREGULAR BLANKS cannot be wrongly located in forming dies if you take two precautions. First, use locating pins that match previously pierced holes in the workpiece. Second, install a large dowel pin strategically placed to orient the blank.



ADEQUATE SUPPORT must be supplied opposite to the cutting edge, in order to prevent shifting or bending of cutoff, trimming or shearing punches. A simple and effective method of providing this support is obtained by lengthening the stock guides and adding punch back-ups.

Effect of Wheel Speed and Work Speed on Grinding Ratio

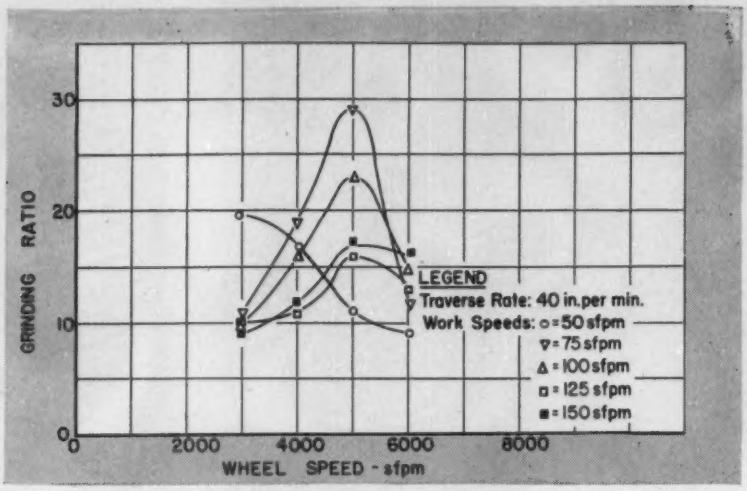


FIG. 1 ... Contrary to previously published data, highest grinding ratio is obtained with wheel speed of 5000 sfpm and work speed of 75 sfpm. These are relative values only and are lower than would normally be obtained. For each test condition, insufficient metal was removed to overcome effect of initial high rate of wheel wear immediately following wheel redressing

Grinding titanium no longer

Has the grinding of titanium thrown you for a loss? Here are latest data on titanium grinding with satisfactory finish, good control of size, high metal-to-wear ratios, and infrequent redressing

Fundamental difficulties in titanium grinding are:

1. Its high solubility in most other metals at elevated temperatures.

2. Its solubility with present-day grinding-wheel refractories at high temperatures.

3. The very high temperatures occurring in the chip-forming process.

The individual grinding grits are subjected to a combination of high temperature and severe solution action of titanium. This can result in direct attrition and dulling of the grains by solution, or in "solution-bonding" of titanium to the wheel, causing "capping" and resultant fracture or dislodgement of the grits. The most practical solution to these difficulties is to reduce the amount of heat generated and to dissipate it more rapidly.

To accomplish this, a new fluid (Cimcool Titan) was developed. Typical cylindrical grinding test results obtained with this fluid applied in conventional manner are shown in Table I. Four successive runs were made, in each case removing 0.090 in. on the outside diameter, in increments of 0.0005 in. per pass. Each run was completed without redressing the wheel (Cincinnati No. 1182). Grinding ratio ranged between 55 and 65, with surface finishes between 20 and 30 mu-in. rms. A finer finish of 10 to 15 mu in. rms can be obtained by periodically redressing the wheel, as for conventional finish grinding.

Data based on internal grinding (Table II) indicated a grinding ratio ranging from 70 to 115. Stock removal was as much as 0.150 in. from a 3¾-in. ID

table I ... EXTERNAL GRINDING

Work Material: Ti 150A — 4⅜ in. long
Grinding Fluid: Cimcool Titan
Grinding Wheel: Cincinnati No. 1182, 14 x 1 x 5
Grinding Wheel Surface Speed: 3850 fpm
Work Speed: 75 fpm
Outside Diameter of Work 2⅛ in. (nominal)

Work dia (at end of run) (in.)	Metal Removal (in. on dia)	Wheel Wear (in. on dia)	Grinding Ratio = Volume of titanium / Volume of wheel
2.252	0.089	0.001	64
2.164	0.089	0.001	61
2.073	0.089	0.001	59
1.981	0.089	0.001	56

Effect of Traverse Rate on Grinding Ratio

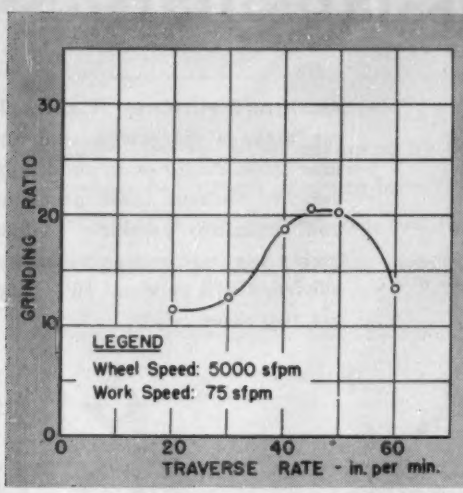


FIG. 2 ... Grinding titanium with recommended wheel-work speed combination, ideal traverse rate is 40-50 ipm for highest yield in metal-to-wear ratio (Grinding Ratio)

Effect of Hardness on Grinding Ratio

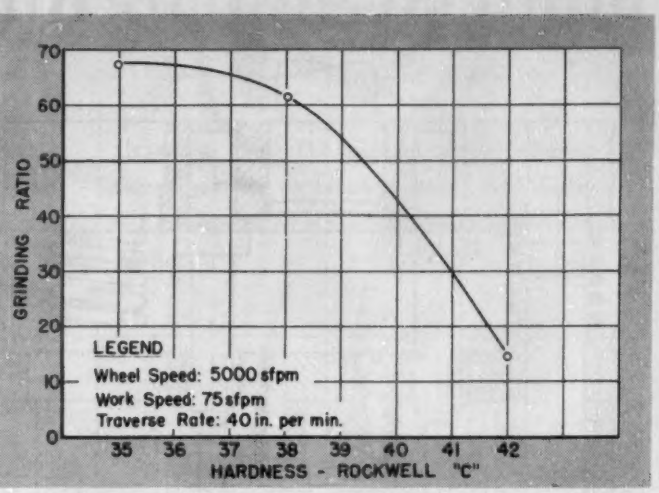


FIG. 3 ... Using proper wheel-fluid combination, best performance is obtained when titanium hardness is R_c 35-38

a problem

E J KRABACHER, senior research engineer
THE CINCINNATI MILLING MACHINE CO, CINCINNATI

without redressing the wheel (Cincinnati No. 1140).

Here are the results obtained from a short run on a production basis of 64 titanium bearing housings, RC-130B, for a jet engine. First operation called for plunge grinding the OD and facing the flange square within close tolerances, Fig. 4. Housings were held in a six jaw universal chuck and the wheel head was swivelled 45° to facilitate plunge grinding. Width

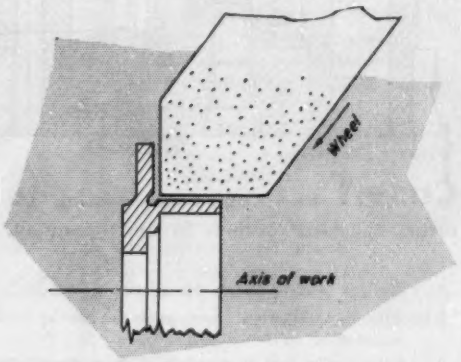


FIG. 4 ... Plunge-grinding OD and flange of titanium housing in one operation with wheelhead set at 45°. Work was ground to within specified tolerances without difficulty

table II ... INTERNAL GRINDING

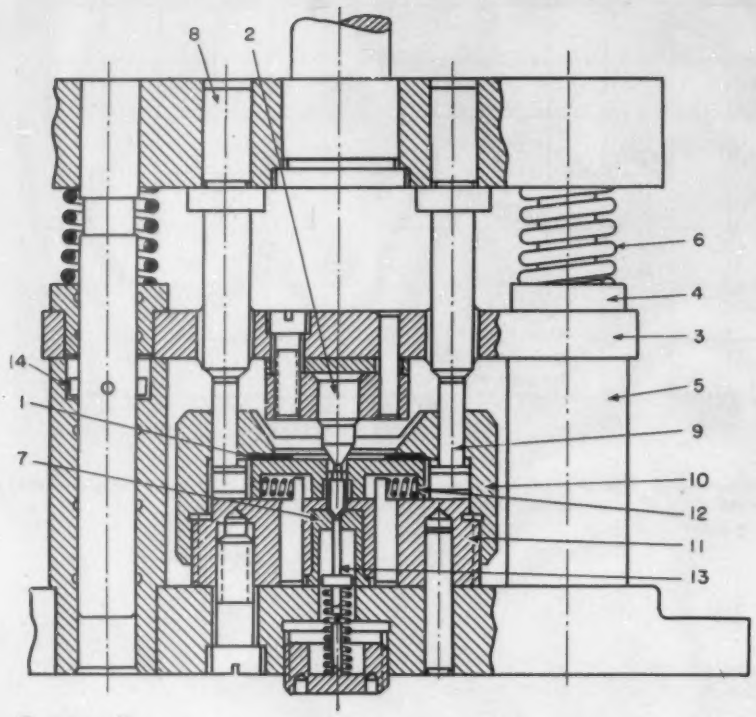
Work Material: Ti 150A — R_c 37-38
Grinding Fluid: Cimcool Titan
Grinding Wheel: Cincinnati No. 1140, 1¼, x 1¼ x ⅜
Grinding Wheel Surface Speed: 4000 fpm
Work Speed: 75 fpm
Internal diameter of work: 3¾ in.

Metal Removal (in. on dia)	Wheel Wear (in. on dia)	Grinding Ratio = Volume of titanium / Volume of wheel
0.144	0.0045	72
0.148	0.0030	111
0.060	0.0017	114
0.056	0.0018	98
0.088	0.0020	97

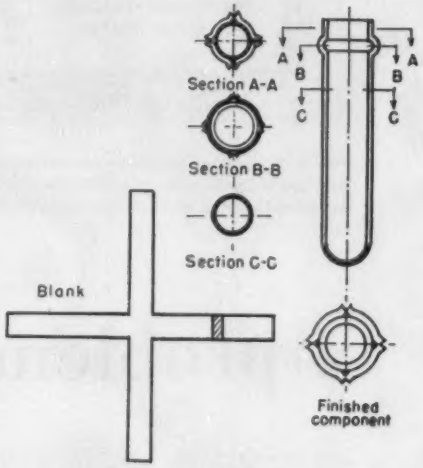
of GD cut was ⅝ in. and flange width was ¼ in. with three ⅝-in. ears spaced 120° apart. Actual wheel speed was 4600 sfpm, work speed was 75 sfpm, and grinding fluid was applied by the conventional overhead flood method; high volume and low velocity. In the roughing operation, 0.020 to 0.025 in. was removed from each surface of the flange and OD. The wheel was dressed open and all 64 housings were rough-ground in 1½ min. per piece without redressing the wheel. Approximately 0.008 in. stock was left all over for finish grinding with the wheel medium-open dressed. For this operation, the wheel required redressing after every 20 pieces while the grinding time was ½ min. per piece with surface finishes ranging from 10 to 15 mu-in. rms. No difficulty was experienced during rough- and finish-grinding operations.

Figs 1, 2, and 3 are taken from an ASME paper presented last December by the author and associates.

Russians harness



AUXILIARY PUNCHES at an angle can make a die complicated and unreliable. Plastic mass can actuate punches without these problems, and equalize pressure without highly accurate cams. Mechanical efficiency will be about 80%. Here are two cases . . .



Case 1 . . . Compound forming die bends spokes and forms spherical bottom in one operation. The sequence . . .

1 .. Blank is hand loaded in nest of die

2 .. When ram is lowered, blank spokes are bent by forming punch mounted in . . .

3 .. Punch holder and intermediate plate of dieset which is controlled by

4 .. Guide bushings for intermediate plate and

5 .. Positive stops for bushings of intermediate plate

6 .. Bending force is transmitted to the punch through two coil springs, preloaded to a force exceeding the bending effort

7 .. At the instant bending of the blank spokes is completed and the spherical end is formed in the die, the intermediate plate stops against the guide bushings

8 .. Press ram and upper plate continue downward movement, further compressing the springs until the pins come up against plungers

9 .. Plungers exert a pressure on plastic mass which fills annular space between

10 & 11 .. base plate and ring

12 .. Plastic mass transmits pressure to rear faces of forming punches moving them laterally toward blank and forming ends of spokes. With upward stroke of ram, pressure on mass is released and springs withdraw side punches. Blank spokes open slightly, because of spring back, and forming punch withdraws.

13 .. Ejector pin "kicks out" finished part from die

14 .. Intermediate plate is raised together with upper part of die by means of collars riding on die posts

---

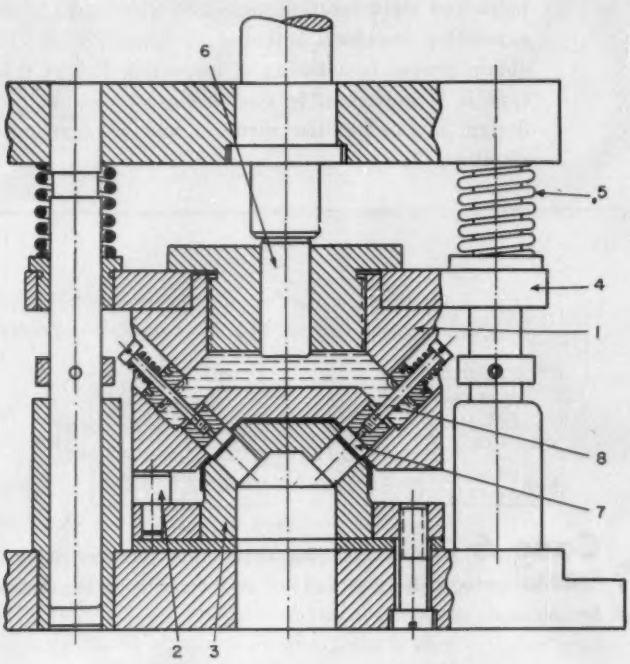
IN THE DESIGN of fixtures where plastic mass must transmit pressure through corners and holes, it is important that cross-sections be adequate, and that the rheological pressure losses through long passages be taken into account. The transmission of pressure from the center to a large circumference should flow through three or four symmetrically distributed radial holes.

In manufacture of these mandrel components, it is recommended that machining of the thin-walled parts should be completed after heat treating. The working surface of the mandrel should be finally machined only after filling with the plastic mass, assembly with the plunger mechanism, and application of pressure to the assembly. Next three cases are examples.

---

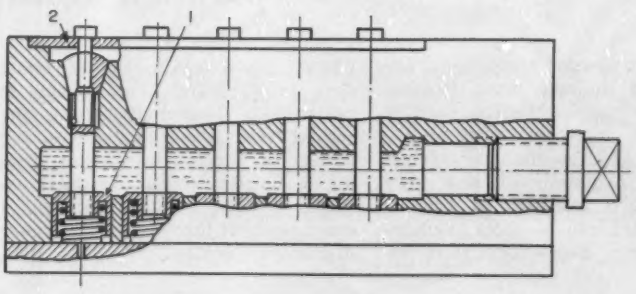
plastic mass for actuating medium

A novel idea has been advanced by Soviet engineers to transmit pressure for clamping workpieces in jigs and fixtures, and for actuating piercing and forming punches in stamping dies. The plastic mass behaves somewhat like an incompressible liquid, under the action of a plunger. Here are seven studies



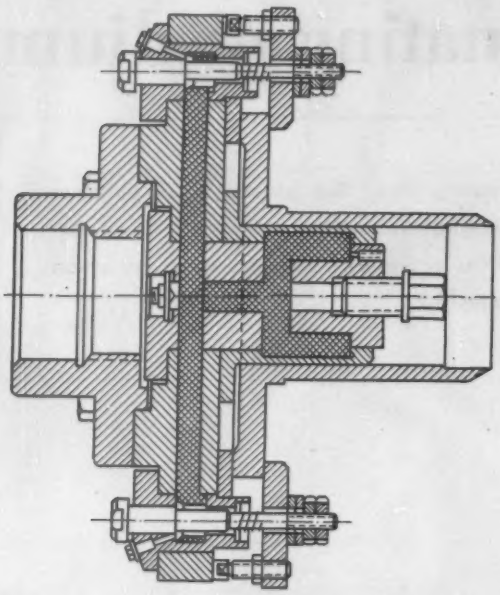
1 .. When the ram is lowered, center piece comes down and butts against . . .
2 .. Buttons, which insure precise location of center piece against
3 .. Boss of the die block, an essential factor for proper functioning of piercing punches
4 .. Intermediate plate stops with center piece
5 .. As the ram is lowered further, the springs are compressed and
6 .. Plunger exerts pressure on plastic mass which fills the hollow space in center piece, transmitting this pressure to the
7 .. Annular faces of piercing punches. Scrap blanks are pushed through the holes in the boss of the die block and the central opening
8 .. After piercing operation, punch block is raised, pressure on the plastic mass is released, and punches are withdrawn to their initial position by springs and studs

Case 2... Piercing die with eight punches actuated by plastic mass for simultaneously piercing holes in pressed cup. The sequence ▲



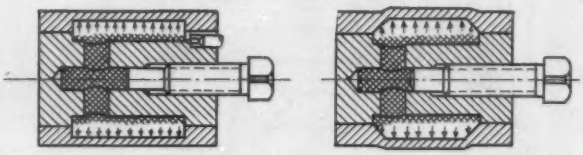
Case 3... Milling fixture shows how hydrostatic transmission of pressure is advantageous in multi-point fixtures.

Collets are drawn into their tapered seats by pressure of plastic mass on plunger face 1. When pressure is released, collet is allowed to expand by action of spring underneath cup. Cover plate 2 serves to position work lengthwise and to protect collet seat from chips



Case 4... Lathe fixture simultaneously clamps workpiece with expanding mandrel and strap clamps. Inspection jigs for numerous purposes, particularly those designed for checking center-to-center distances between holes, insure a precise method of dimensional control. Clearances between reference holes and rigid locating studs are eliminated with expanding mandrels actuated by plastic mass. To obtain proper functioning of inspection jigs of this type it is important to exercise great care in the design of combination mandrel and plunger mechanisms

IN PRACTICE, collets are normally designed with stiffening collars at both ends of the thin-walled cylinder. Care should be exercised when designing the stiffening rings so they do not interfere with the free deflection of the cylinder and introduce local bending stresses in the neighborhood of stiffening rings. In choosing the wall thickness of the shell, it is well to consider two factors. First, the shell must possess sufficient elastic deformation to exceed the maximum clearance between the workpiece and the mandrel, to insure reliable clamping. Second, the mandrel must be safe against failure by rupture or by plastic deformation. Here's a typical design:



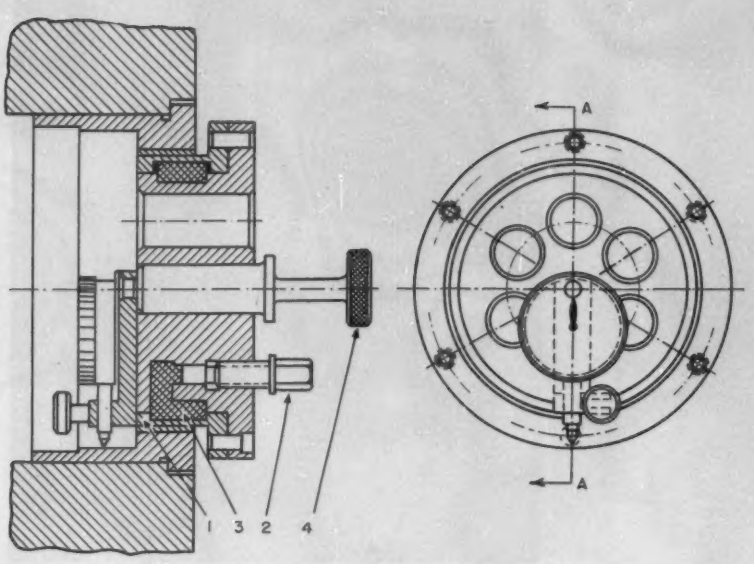
Case 6 ... Expanding collet and plunger design. Note stiffening collars at ends of collet and area expanded by pressure of plastic mass.

Preparation of the

Composition of the plastic mass is:

Emulsified polyvinyl chloride (PVC)	100	parts
Dibutyl-phthalate	290	"
"Vacuum" oil	100	"
Calcium stearate	4	"
Specific gravity of plastic mass	1.018	

Liquid and powder components are mixed to a uniform mass. Heating takes place in a vessel surrounded by a glycerine bath and must be accompanied by continuous mixing. The mass, originally of dark gray color, is first transformed from a liquid state into a thick yellow-brown syrup. Subsequently it becomes liquid again, taking on a deep brown color. Good mixing is particularly important during the second transformation, where the danger of burning is greatest. Curing is finished when the mass assumes a light brown color and a consistency of thin syrup. The vapor discharged during curing is dan-



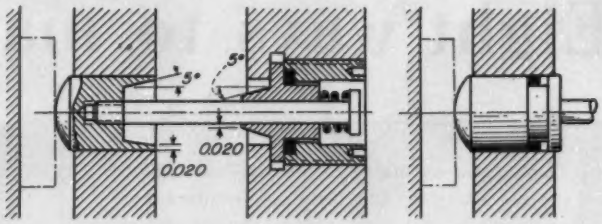
Section A-A

Case 5... **Inspection jig designed for checking concentricity of two internal bores. Here's how it operates . . . Jig swivels in the inner bore of the locating mandrel 1. Piston screw 2 activates the plastic mass 3 which pressurizes the mandrel shell, thereby centering the jig on reference bore of work. Hand knob 4 rotates the dial indicator within the bores**

WHEN DESIGNING plunger mechanisms, the following clearances should not be exceeded:

Pressure in Plastic Mass, psi				
356	711	996	2133	3555
Clearance, in.				
0.002	0.0016	0.0012	0.0008	0.004

Although the clearances required are not of the same order of magnitude as those in hydraulic components, they are nevertheless tight and call for precision machining. It is often advisable to use seals and gaskets of a type familiar in hydraulic systems. Here's an exception . . .



Case 7 ... **Plungers may be designed to eliminate seals and gaskets, by designing them in such a way, that under pressure of plastic mass, elastic deformation of the plunger will seal against the cylinder wall**

plastic mass

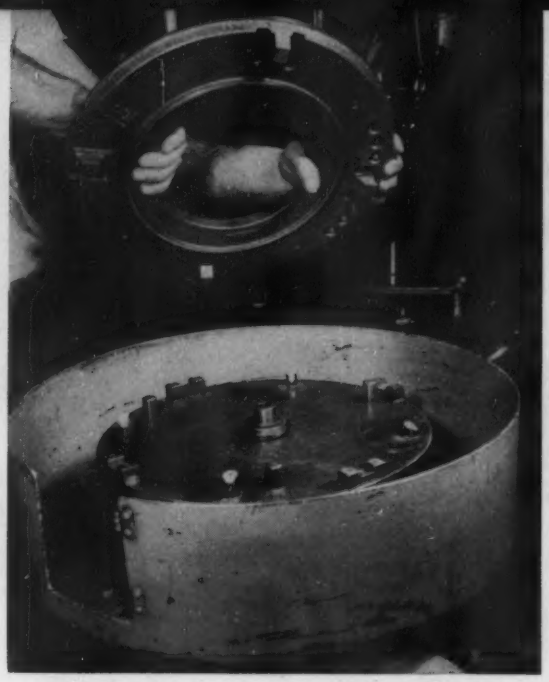
gerous to health, so the process must be carried out in a special ventilated chamber.

The finished plastic mass is poured out into metallic forms, and cooled to room temperature. After cooling, the physical properties of the plastic resemble those of latex and the plastic should be stored in a cool dry atmosphere until it is needed.

Charging of a fixture with plastic mass is carried out after reheating of the plastic to 266-302F in a glycerine bath, with constant mixing. Just before pouring, the temperature is raised to 302-320F. Contraction of the plastic must be taken into account and some form of riser provided. The plastic can be liquefied for emptying the fixture by raising the temperature to 266-302F.

Abstracted from several articles in "The Engineers Digest," London. Original information was abstracted from the Russian journal "Stanki i Instrument."

CONVERTED BROWN & SHARPE GEAR CUTTER is fitted with air-operated drawbar in spindle and removable spider that grips clutch plates while four lugs are being milled. One operator handles two machines, setting one up while the other is working



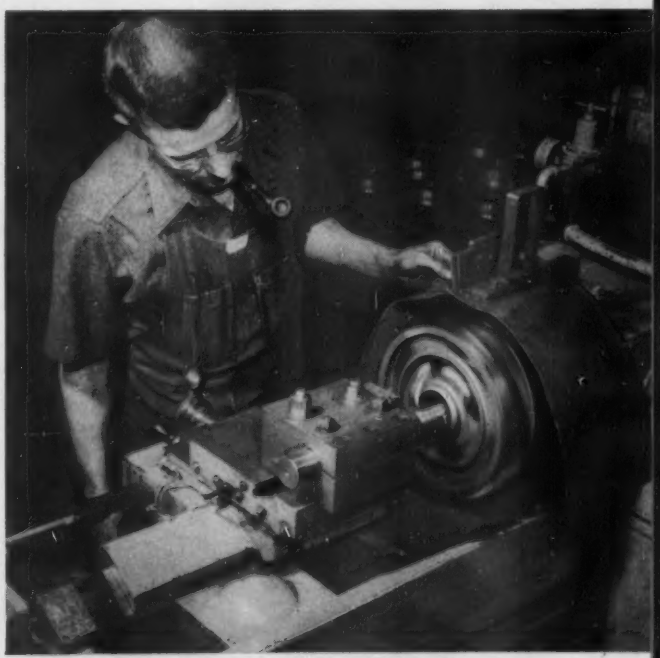
BLOW STAND CLEANS OUT DRILLED HOLES in clutch plates in one operation. Cylinder underneath table feeds air to four jets that may be adjusted to new positions for other parts by replacing fixture. Unit is safer and faster than air hose

Eight ways to make pneumatics

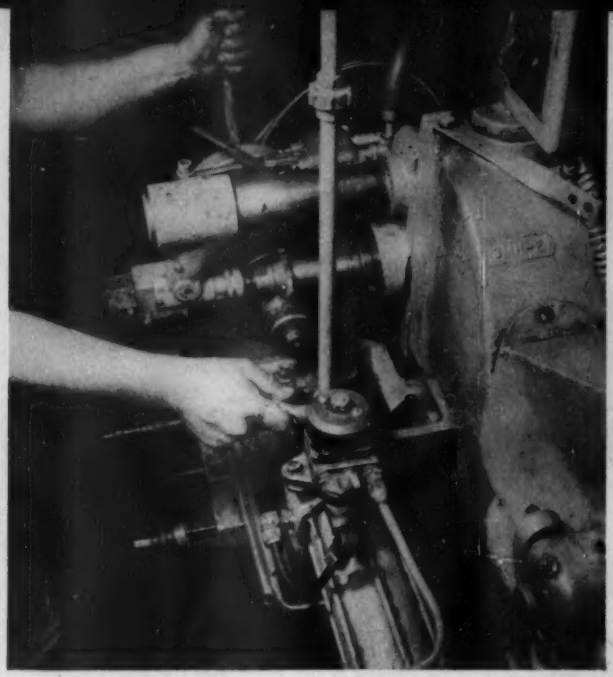
Compressed air makes machining faster, physical work easier, and controls machines automatically at this plant where experience with air power is well seasoned.

Air applications at Lipe-Rollway started before the war, when the impetus was for lightening physical effort when heavy clutch parts were handled. Now machinists use compressed air wherever possible.

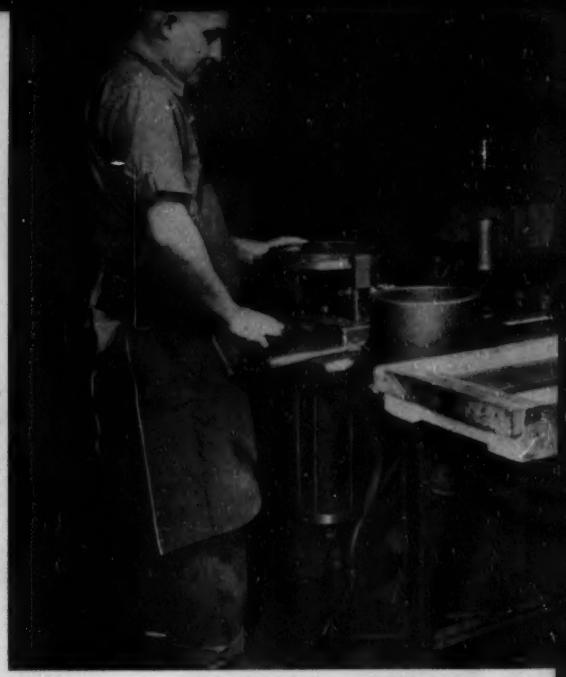
Setups are simplier as a result. T-wrenches, foot controls, hand-chucking, and hand-drilling have given way to check and shutoff valves, meters, oiling systems, limit switches, and air cylinders. Air isn't the only power source, for some setups use combinations of air and hydraulics or electrical devices, but air is the main prime mover throughout the plant. Most machines have air chucks, spindles, or collets; and air powers drills, lathes, boring mills, and assembly-bench fixtures. Chips are removed from the plant by two air cylinders and a conveyor belt. Scrap carts are lifted and contents dumped onto the conveyer by an air-powered hook, and air-activated doors let the discarded chips fall to an outdoor disposal box.



CARBO-LATHE, BUILT IN THE SHOP, spotfaces clutch plates to overall height and forms centering angle in plate bores. Air power grips work, moves carriage through rapid advance and cutting pass, limit switch stops motion, and air returns carriage to starting position automatically



MILLER WITH AIR CONTROLS cuts two keyways, 180° from each other, in clutch sleeves. Work is gripped against faceplate by air-operated drawbar, then air cylinder advances and retracts table for first pass that cuts first keyway. Arbor is rotated by hand

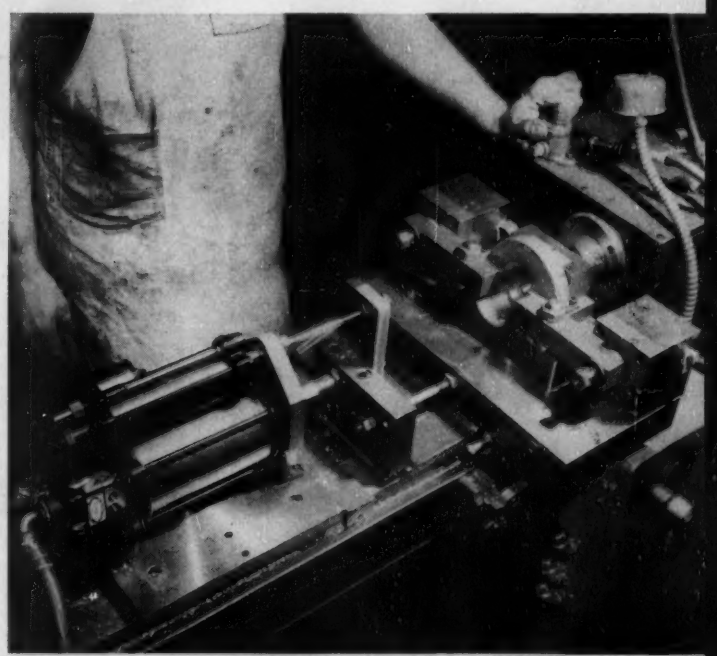


ASSEMBLY BENCH IS AIR OPERATED to compress heavy clutch springs so levers, steel balls, fulcrum, and snap rings can be added to main plate, flywheel ring, and sleeve that have already been assembled

practical

LAURENCE H KIRK, general superintendent,
LIPE-ROLLWAY CORP, SYRACUSE, N Y

SPIN BALANCER CHECKS CLUTCH ASSEMBLY by rotating it, which throws weights on balancer shaft to lighter side of clutch. Rig, which was made in Lipe plant, is calibrated to show where to air-drill clutch plate on heavy side to equalize weight

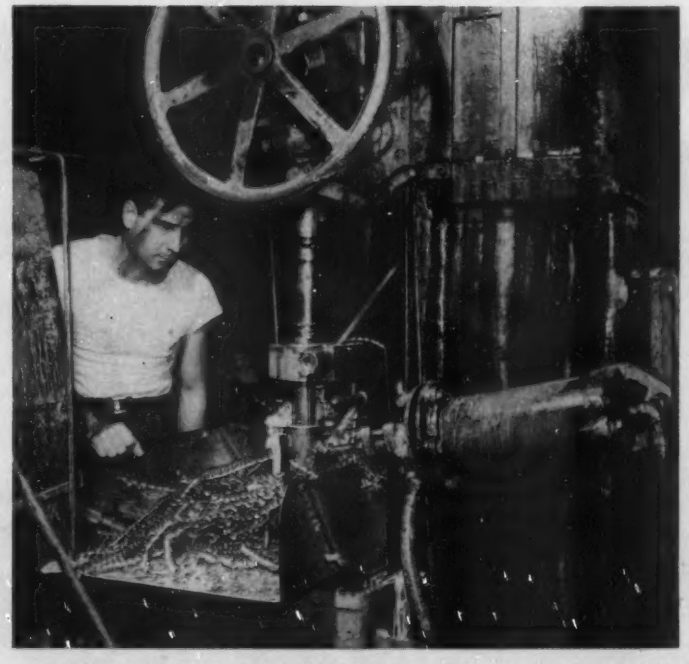


CONVERTED 9-IN. LATHE BORES ID'S of two cyclic-balancer castings at once. Air cylinder at left pushes carriage forward to force stock over revolving boring bar at machine head, right. Air clamps workpieces to boring fixture

AIR PRESS SLAPS DISKS to take out minor warp spots. Two levers control air from 90-100-psi line to make average of four slaps per assembly. Upstroke is cushioned by air to prevent damage to press

Eight ways to make pneumatics practical . . .

continued

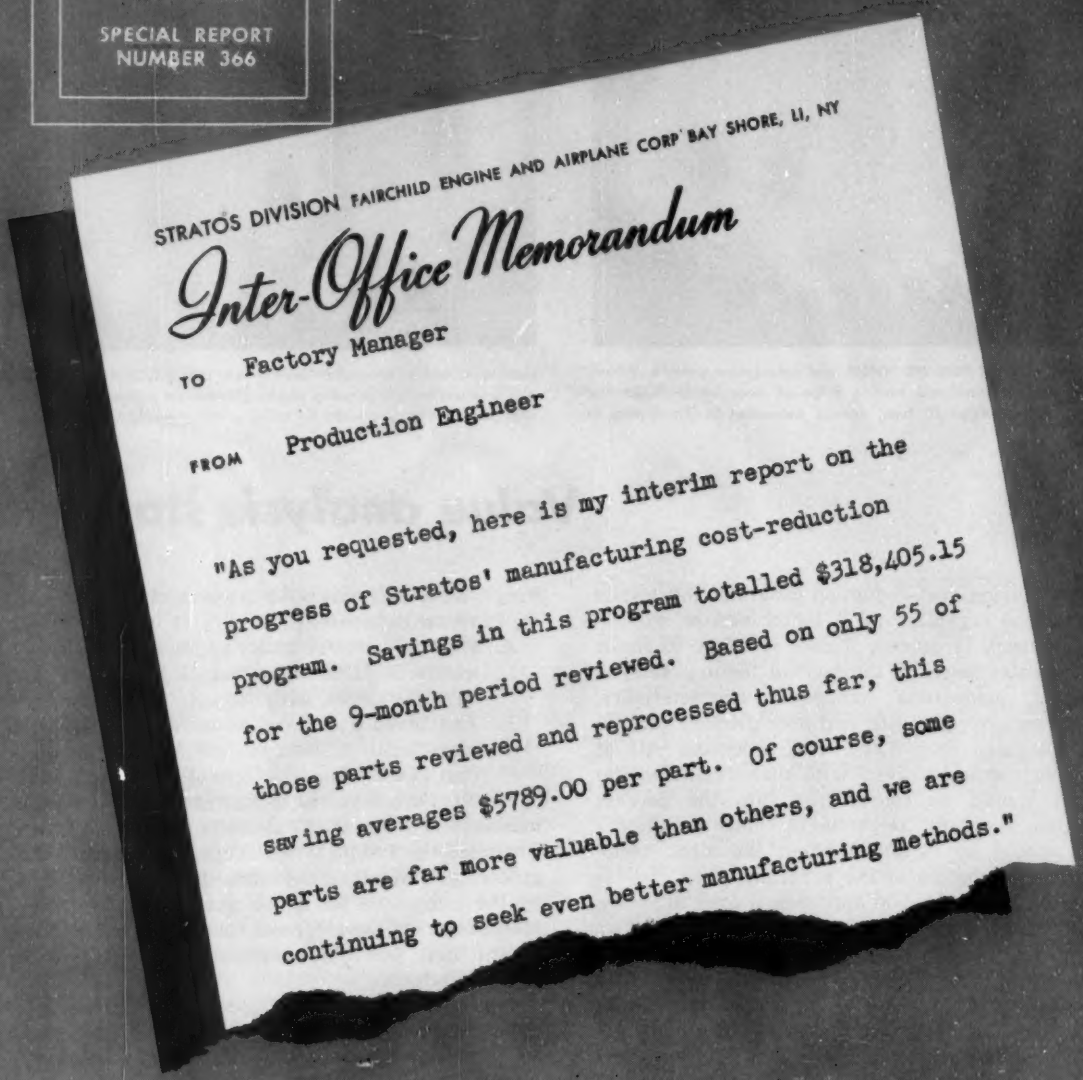


BAKER DRILLPRESS BORES CLUTCH HUBS; has two air devices. One air cylinder moves fixture that locates and holds hub in place under spindle; another works from foot control to raise and lower drill for feeding

ROUGH-TURNING LATHE FACES AND FORMS clutch pressure plates as air-actuated drawbar inside spindle pulls on spider work holder. Line pressure of 90 psi is enough to grip work securely

American Machinist

SPECIAL REPORT
NUMBER 366



STRATOS DIVISION FAIRCHILD ENGINE AND AIRPLANE CORP' BAY SHORE, LI, NY

Inter-Office Memorandum

TO Factory Manager

FROM Production Engineer

"As you requested, here is my interim report on the progress of Stratos' manufacturing cost-reduction program. Savings in this program totalled $318,405.15 for the 9-month period reviewed. Based on only 55 of those parts reviewed and reprocessed thus far, this saving averages $5789.00 per part. Of course, some parts are far more valuable than others, and we are continuing to seek even better manufacturing methods."

Process evaluation
pays long-term dividends

WM M STOCKER, JR, associate editor

NOTE TO MANAGEMENT: Here, for your information, are the elements covered in the report described in the memo, which tabulated substantial savings in the manufacture of intricate and critical aircraft accessory components. New applications include investment casting, plaster mold casting, die casting, powder metallurgy, barrel finishing, reinforced plastic molding, and stamping. Based on Stratos' findings, we describe with many photographic examples, value analysis, previous and new processes, tooling studies, cost factors, break-even points, and general recommendations.

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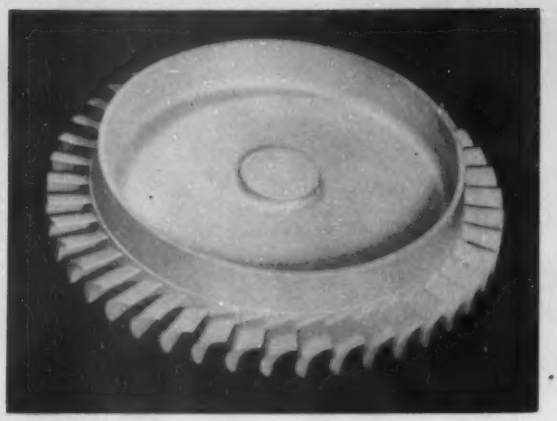
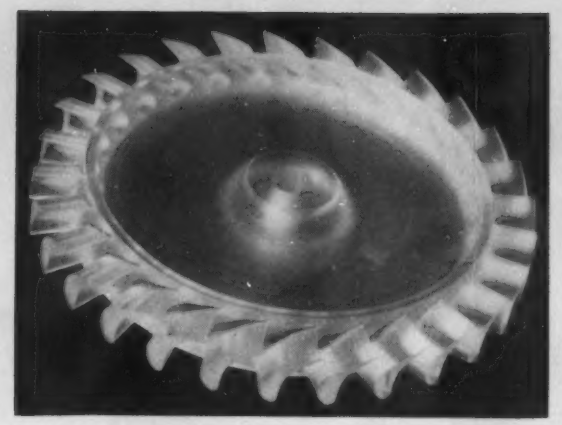


INVESTMENT CAST TURBINE WHEEL and polystyrene pattern. Wheel is 410 stainless steel and trailing edge of each blade tapers to 0.011-in. radius. After 10 tries, vendor succeeded in developing a technique which permitted casting on a production basis. Mold cost was saved by machining plastic patterns on profiler until process was proved. Part produced by usual practice would cost $230 more



Value analysis starts at

Manufacturing-cost-reduction programs must start with careful organization. A helter-skelter, hit-or-miss approach to process studies is likely to result in far greater losses in impractical tooling, delayed deliveries, inadequate component characteristics, lowered employee morale, and poor product quality, than the gains from lower-cost processes. All of the departments involved with manufacturing the product should be coordinated into the process evaluation program. Department heads and supervisors should be informed about the aims, techniques, and progress of the program.

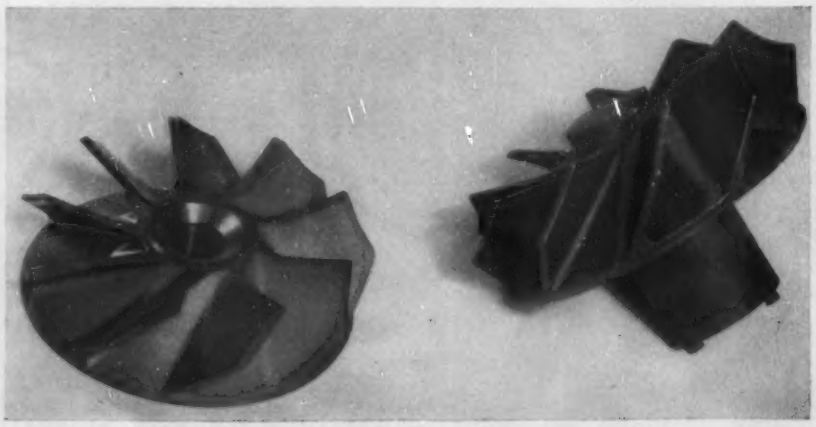
At Stratos a three-fold approach is used to assure production at low cost.

Key group in the program is the Manufacturing Development Committee, comprised of the industrial engineering supervisor, the chief purchasing agent, the chief design engineer, and the chief inspector. The committee operates as a "future planning" team and meets at regular, fixed intervals. Its function is two-fold:

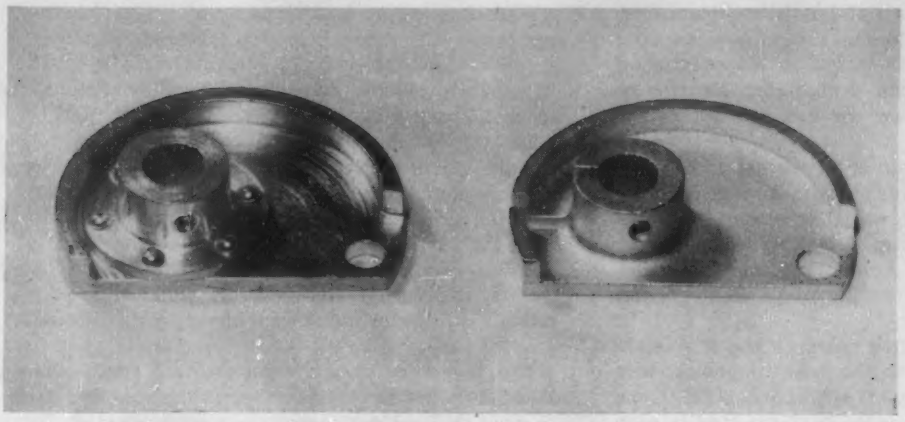
A. The evaluation of future engineering designs to assure suitable manufacturing facilities and supply sources, and;
B. The investigation of advances made in the manufacturing field to evaluate their application to the company's operations.

Findings are reported to management and recommendations are made. The staffs of the Production Engineering, Product Engineering, Industrial Engineering, and other departments are drawn upon by the committee for detail work. Objective of the Manufacturing Development Committee is assurance of the best possible manufacturing facilities for future products.

Operating at the planning level are members of the production engineering department who review all drawings made for manufacturing purposes to



MACHINING TIME OF 9.6 HR on this blower (410 stainless steel) was avoided by designing it for investment casting. Large hub is used as a chucking lug; then machined off. Small boss remains where sprue was cut off. Wheels operate at 45,000 rpm; are tested at 90,000 rpm and Zygloed after machining. Pattern is molded polystyrene. Blade milling is eliminated and all machining is done on lathe. If produced by commonly used practice, cost would be nearly three times present



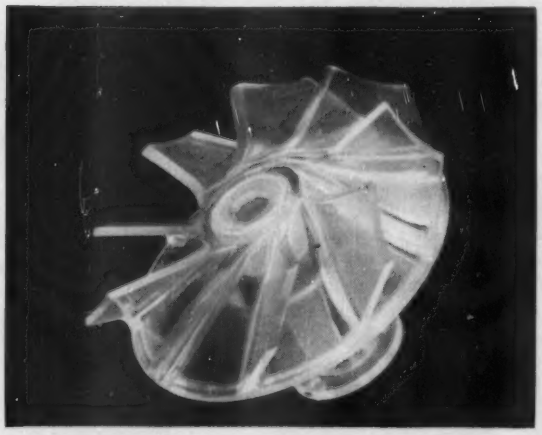
TWO MACHINED PIECES were assembled by riveting (left) to form this cam. Now piece is integrally investment cast (right) for a saving of $9.86 in machining costs

the end product

apply cost reduction techniques where possible. Changes made at this level generally are minor in nature because of prior review of the product by the manufacturing development committee.

Rounding out the program is the industrial engineer who is in charge of what might be called "the re-evaluation phase." A continuous review of all products is maintained, part by part, to determine whether the quantity required has been increased enough to warrant changes in manufacturing practices or whether the part can be produced at lower cost by any new equipment obtained for the plant.

Process evaluation starts at either of two end points. For components in use, or being manufactured, the process engineer starts in Stores or in Planning. For newly engineered parts, not yet in manufacture, evaluation starts with the detail-part drawings. While the latter stage certainly presents the most sensible place to start, before tooling and manufacturing begin, it is also extremely fruitful to analyze process techniques for components actually in production. This category frequently is in the realm of "habit" or "tradition"; is less subject to the cost-conscious critical eye. Also, it may seem extravagant to begin evaluation of newly engineered components *after* completion of the detail drawings. Actually, it has proved more practical to allow designs to be completely worked-out from the ideal engineering standpoint, with only an occasional assist from Process Engineering, before methodizing, rather than to continually interrupt the smooth flow of product development.



Completed drawings permit rapid manufacture of working prototypes and allow quicker visualization of design changes to simplify manufacture. Drawing changes as a result of process evaluation are seldom of major proportions; are usually limited to single parts and small subassemblies. Engineering administration, too, must be evaluated in terms of a "break-even" point. While it is valuable for designers to be process and cost conscious, their natural concern is a workable design. Thus, trained manufacturing specialists frequently are consulted on manufacturing processes. Practical process selection requires knowledge of many methods.

At Stratos, process evaluation is divided into two phases, as described above. In Phase I, every new part is marked for process by the designer but each drawing must be approved by Process Engineering before it can be released for Manufacturing or Purchasing.

Design changes necessary to expedite or improve manufacturing are discussed with the engineers and designers responsible for the project. Characteristics essential to the proper function of the component are studied in terms of the new process and, in many cases, suppliers' field engineers are brought

in for consultation. When it has been established that the new process is practicable, a new drawing is made and an order is issued to Manufacturing or Purchasing. Sometimes, preliminary samples of the part are made before the new process is accepted.

Phase II of the program is an evaluation of parts already in production. This phase is approached from two directions—Planning and Purchasing. It is implemented by advice from Tool Engineering, Time Study, Manufacturing, Accounting, and other departments. Design Engineering plays an important part in this phase too.

A survey of the finished parts on the shelves in the storeroom may not be the most methodical way to tackle this problem, but it is practical. Taking one section at a time, the process engineer studies each piece. He makes notes of ideas and possible improvements; then requisitions a sample of each of the parts that warrants evaluation and reprocessing, plus a detail blueprint of the part drawing and the subassembly drawing. He reviews the inventory record and anticipated requirements for each of these parts to determine such data as:

1. Source
2. Frequency of demand
3. Quantities used and stored
4. Related or similar parts
5. Value (cost)

With all of this background material at hand, the Process Engineer is ready to determine which items deserve first consideration and to evaluate first, the present method and then, other "approaches" or process possibilities.

With Purchasing as the point of origin for the evaluation, the same routine is followed. However, in this category selection of parts for study is based on vendor problems, delivery delays, difficult tolerances, unusually high cost, and similar conditions.

Thus, to evaluate a considered change, first determine where the largest items of the cost are. For instance, determine whether it is in material or labor that the greatest area for saving lies. Then consider the number of pieces to be made (immediately and long-range). Each evaluation is a product of factors, and each factor must be weighed as it is established. Factor influence will vary with different product lines.

Break-even point is the determining result after all of the other factors have been evaluated and one or more applicable processes have been selected. For the casting processes and stamping, which studies have shown as the most beneficial in reducing the cost of parts such as Stratos manufactures, break-even point is determined as:

$$\frac{D}{N} + (P + M) = \text{piece cost per piece for given no. of pieces (A)}$$

where D = die, or mold, cost
N = no. of pieces to be made
P = cost per piece before machining
M = machining, or finishing, cost per piece
and, C = present cost per piece
x = *Break-even Point*

Then,

$$\frac{D}{x} + (P + M) = C \text{ or, } x = \frac{D}{C\text{-}P\text{-}M}$$

EVALUATION EXAMPLE . . . *turbine-wheel manufacture*

Four years ago Stratos received one of the first large-scale production orders placed for air-turbine drives. As these devices were operated directly from the jet-engine compressor air, without passing the air through a heat exchanger, turbine-drive air-inlet temperatures were approximately 450 F. This temperature did not require a change from aluminum to a more temperature-resistant material. However, more-recent orders call for 750 F and higher air-inlet temperatures and a material other than aluminum is necessary. To keep wheel costs as low as possible, three approaches to this problem were made:

1. Turbine wheels could be machined from steel, just as aluminum wheels were machined. However, this method had at least two serious drawbacks:

a. The piece geometry was such that only a very small cutter could be used. At the low speeds and high feeds necessary for milling steel, the small, shank cutter was limited in the load it could absorb.

b. Machines on hand for milling aluminum were not sufficiently rugged in spindle or pantograph construction to take the additional load imposed by machining steel.

Action: A pantograph was developed which enabled interchange of all existing tooling. This machine, built for Stratos by the George Gorton Machine Co, has a much heavier pantograph arrangement and a mounting pad for the cutting spindle. Also, two spindles were supplied, one low-speed for steel and one 45,000 rpm for machining aluminum. The machine operates automatically on the profiling cycle. Now, with two of these machines, Stratos can make the high-temperature wheel under its own control and with relatively low tooling cost. However, while this method is suitable where the production run is short it is expensive when compared with methods devised for longer runs.

2. If it was difficult to machine or cut the material to be removed, the material could be cast into the desired shape. This, too, had its drawbacks. First, a lost-wax or a lost-plastic method would have to be used. This technique requires a mold to produce the pattern, the exact image of the wheel in wax or

SAVING ON PARTS ACTUALLY ORDERED

NAME	FORMER PROCESS	OLD COST	NEW PROCESS	*NEW COST	SAVING PER PIECE	INITIAL† SAVING
Sleeve	Bar Stock	4.33	Bushing Mfgr.	1.00	3.33	1,998.00
Stator	Bar Stock	11.37	Precision Casting	5.45	5.92	2,220,00
Link	Bar Stock	4.12	Precision Casting	3.55	0.57	128,25
Link	Bar Stock	4.69	Precision Casting	2.82	1.87	794,75
Link	Bar Stock	0.89	Stamping	0.36	0.53	137,80
Coupling	Bar, Stock	3.52	Precision Casting	2.19	1.33	678,30
Link	Bar Stock	4.11	Precision Casting	3.00	1.11	610,50
Housing	Bar Stock	7.17	Precision Casting	2.85	4.32	1,512,00
Retainer	Sand Casting	8.19	Die Casting	4.81	3.38	6,760.00
Guide	Purchased	1.73	Precision Casting	0.72	1.01	2,626.00
Support	Purchased	3.03	Precision Casting	2.41	0.62	1,240.00
Cover	Sub-contract	0.76	Stamping	0.22	0.54	1,161.00
Washer	Sub-contract	0.42	Stamping	0.13	0.29	551.00
Retainer	Sand Casting	6.41	Die Casting	3.05	3.36	6,720.00
Cover	Bar Stock	4.91	Die Casting	2.35	2.56	5,888.00
Cover	Sand Casting	7.14	Die Casting	2.02	5.12	10,240.00
Cam Assy.	Assembly	8.58	Precision Casting	1.87	6.86	12,348.00
Plate	Purchased	1.15	Die Casting	0.57	0.58	1,131.00
Nut	Bar Stock	2.76	Precision Casting	1.04	1.72	1,720.00
Plate	Bar Stock	1.78	Stamping	0.28	1.50	450.00
Blower	Brazed Assy.	78.08	Precision Casting	20.92	57.16	59,160.00
Fairing	Sand Casting	4.41	Die Casting	2.57	1.84	1,564.00
Sleeve	Bar Stock	5.34	Bushing Mfgr.	2.25	3.09	772.50
Plug	Bar Stock	1.68	Specialty House	1.00	0.68	136.00
Plate	Plate	7.26	Stamping	4.04	3.22	1,352.40
Washer	Bar Stock	1.48	Specialty House	0.35	1.13	508.50
Actuator	Bar Stock	3.29	Precision Casting	1.47	0.55	455.00
Shim	Tubing	1.41	Stamping	0.91	0.50	375.00

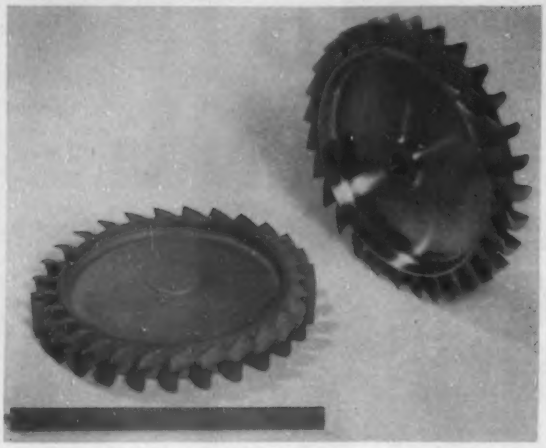
PLEASE TURN PAGE→

SAVING ON PARTS ACTUALLY ORDERED, Cont'd

NAME	FORMER PROCESS	OLD COST	NEW PROCESS	*NEW COST	SAVING PER PIECE	INITIAL† SAVING
Diffuser	Sand Casting	58.43	Precision Casting	14.21	44.22	134,384.58
Retainer	Sand Casting	10.12	Precision Casting	6.90	3.22	1,610.00
Fan Wheel	Disc Forging	31.20	Die Forging	29.95	1.25	3,875.00
Blower	Disc Forging	24.70	Precision Casting	19.38	5.32	8,512.00
Housing	Bar Stock	6.18	Die Casting	3.62	2.56	8,960.00
Slinger	Bar Stock	6.30	Stamping	2.75	3.55	10,295.00
Plug	Made From 721-CF	0.59	Mfgr. Furnish Complete	0.39	0.20	60.00
Retainer	Bar Stock	2.17	Purchase	0.90	1.27	635.00
Screw	Bar Stock	5.99	Purchase	4.25	1.74	870.00
Blower	Bar Stock	4.16	Precision Casting	2.24	1.92	960.00
Shaft	Bar Stock	3.43	Specialty House	2.08	1.35	675.00
Bushing	Bar Stock	1.99	Bushing Mfgr.	0.81	1.18	590.00
Plate	Bar Stock	1.37	Stamping	0.19	1.18	590.00
Link	Bar Stock	2.00	Stamping	0.32	1.68	840.00
Bushing	Bar Stock	2.27	Bushing Mfgr.	0.92	1.35	675.00
Butterfly	Sand Casting	7.15	Die Casting	6.76	0.39	634.53
Guide	Sub-contract	0.92	Stamping	0.22	0.70	1,050.00
Pilot Assy.	Assembly	16.54	Precision Casting	1.92	14.62	7,310.00
Housing	Purchased	5.00	Precision Casting	3.96	1.04	520.00
Trip	Purchased	3.85	Precision Casting	1.41	2.44	1,220.00
Actuator	Bar Stock	3.52	Precision Casting	1.75	1.77	885.00
Diffuser	Bar Stock	35.50	Precision Casting	22.75	12.75	2,767.00
Wheel	Disc Forging	46.30	Die Forging	41.83	4.47	4,470.00
Butterfly	Sand Casting	10.00	Die Casting	6.77	3.23	1,705.44
Arm	Bar Stock	4.13	Precision Casting	2.82	1.31	620.00
Eye	Bar Stock	2.70	Flat Stock	1.68	1.02	204.00
Bushing	Bar Stock	3.72	Precision	3.26	0.46	253.00

*Die or tool cost amortized

†Does not include calculation of future savings for continued production



6-IN.-DIA, 4.14-LB INVESTMENT CASTING was an experiment to determine whether a casting this size was feasible. Material is N-155 alloy. Successfully cast, blade trailing edges are held to 0.012-in. radius and surface quality was such that not even a clean-up operation was necessary. Estimated time for machining from wrought alloy bar was 40 hr while 3 hr completed the part from the as-cast condition. Parts are shown as-cast and finished

PLASTER MOLD PRECISION CASTING instead of sand casting for this stator is *1/3 of the cost of a sand casting*. Sand casting would require machining ring off each end and smoothing of blade surfaces and areas between the blades. Plaster mold casting (left) is shown as received. Machining time is only a tenth of that a sand casting would require, total cost one-fifth that of a finished sand casting

plastic, and the mold cost would be high ($5000 to $10,000) for the required number of pieces.

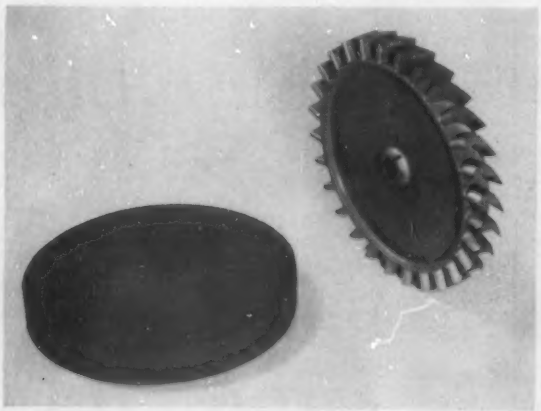
Second, the piece geometry still was a problem. There are many thin sections to cope with in casting a turbine wheel so a high scrap rate could be expected if blade cavities did not fill. Very few firms would tackle the job. Stresses due to high rotative speeds and temperatures required high strength characteristics.

Action: An exhaustive search was made of the casting industry to obtain a vendor who was willing to experiment with these very difficult castings.

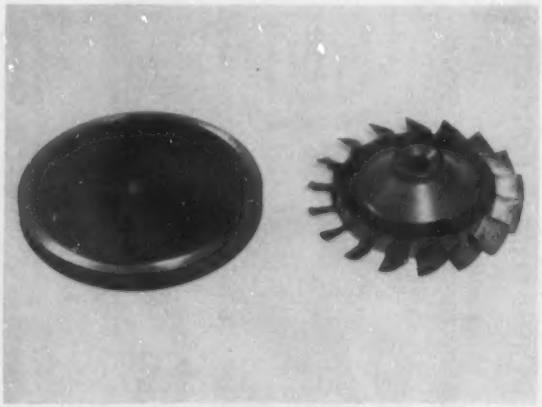
To eliminate the high mold cost, polystyrene patterns of the parts to be cast were made on the pantographs. These patterns then were sent to a number of investment casters and they supplied sample castings which were inspected and tested. Two companies were selected as the most suitable vendors for these parts.

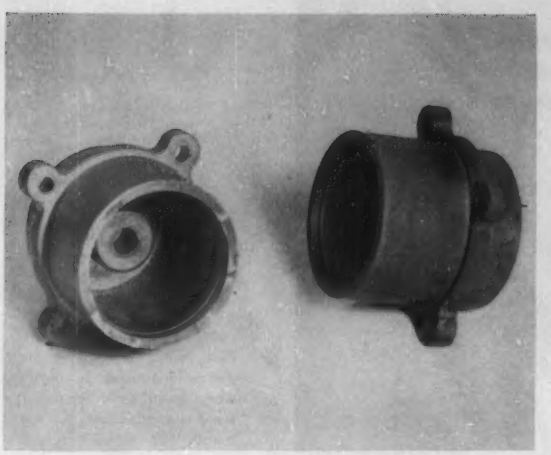
Turbine wheels for some applications were produced by casting in 410 or 416 stainless steel. If machined from bar stock, these wheels would cost $200 more per piece, a clear indication of the economic value of the new casting practice.

3. In the two previously mentioned approaches, only steel was considered as the material to be used to withstand the higher temperatures. The problem also could be solved by finding a material which would stand the heat *and* machine with the ease of aluminum. Metal powder methods were tried. A sintered compact, which is basically powdered iron and copper, was found suitable. The material was supplied in the form of a disk made by squeezing the powder in a mold at very high pressure and

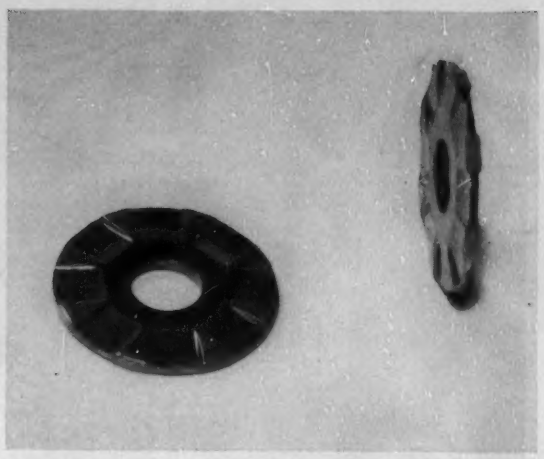


POWDER METALLURGY, in the form of a sintered iron and copper compact, provided a material capable of operating at higher temperatures and almost as machinable as aluminum alloy. After solution heat-treating and precipitation hardening to R_B 100, the piece is completely machined in 4.4 hr whereas wrought steel takes 40 hr. Aluminum blanks are completed in 3.3 hr





DIE CASTING is received as shown (left). Originally this part was made from a sand casting which required machining all over. Now, as shown by finished piece (right), only slight clean-up is necessary and cost is less than half



COINED STAMPING, 1½-in. dia by 3/32-in. thick and SAE 4130 steel, replaces oil slinger sliced from bar and milled. After heat-treat to R_c 28-32, part is surface ground. In stamping, eight depressions are held to 0.040-in. depth + .010, – .000. Shop cost was reduced from $6.30 to $2.54 per pc

sintering the compact. This material proved excellent at withstanding temperatures higher than those at which aluminum could be used and operated successfully at 6-in.-dia-wheel speeds of 45,000 rpm. This material, 98% dense, machines without coolant at almost the same rate as aluminum.

But this material, too, has its drawbacks. The dies necessary to make the disks are approximately $5000. (Remember, these dies do not eliminate machining, hence are not as rapidly amortized.) However, while not used at present for this application, a material other than steel which will do the job was found.

In summary, machining and casting techniques were developed to produce at reasonable costs turbine wheels and other components which would meet the higher temperature requirements.

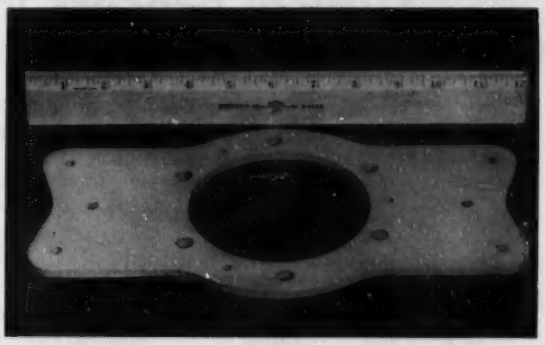
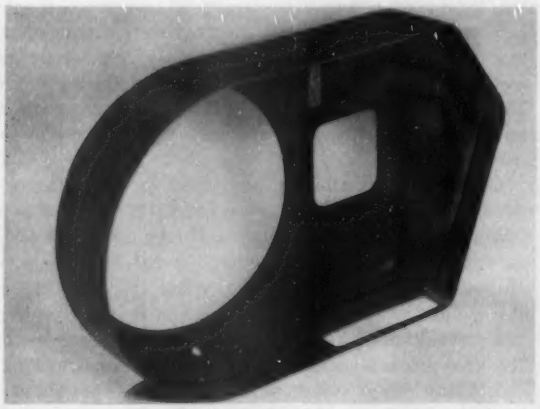


PLATE formerly was bored, drilled, and contour profiled from solid 11½-in. by 6-in. by ¼-in.-thick piece of 245-T4 aluminum. Now made as a stamping, the cost is reduced 50%



REINFORCED PLASTIC replaces sheet aluminum in these parts formerly deep-drawn. Material is 0.080-in. thick. Process change greatly reduced tooling charges and eliminated small-quantity premium. Product has improved appearance, is lighter, and is less easily dented

LABOR COST WAS REDUCED 75%, while productive capacity increased 25 times, when barrel finishing equipment was installed. For example, one steel piston was hand burred at a rate of 32 pc in 8 hr. Now 800 pc are completed in 8 hr using only 25% of the labor

Typical process improvement studies

Many processes new to Stratos and in keeping with the most recent developments in Industry have been introduced in the course of this cost-reduction program. They have enabled the company to increase productive capacity manyfold and to, simultaneously, improve product quality. In every case, sizable cost reduction has been achieved. Meanwhile, engineers have gained a great deal of knowledge of these subjects which will be of considerable aid in estimating future work and in planning factory capacity. Future evaluation will include an analysis of machine-tool application and study of new metal-removal processes.

The present program included:

1. Investment casting (lost wax, lost plastic) of many small, intricate parts that formerly were machined from solid bar. Thus, considerable milling and drilling are eliminated. Close tolerances are held which otherwise would necessitate precise machining and expensive tooling.

Some assemblies which formerly required separate manufacture of components and then an assembly operation are now cast as integral units. Simplified designs are possible that would be prohibitively expensive or impossible to machine. This use has lowered costs and machine loads.

2. Plaster-mold (precision) casting eliminates profiling of blade sections on stators which formerly required turret lathe and profiler operations. Critical shop equipment is relieved for other work and costs are reduced 30%. Savings as high as 78% have resulted from changing from sand castings to precision castings. The surface finish of the latter is excellent.

3. Die castings, initially, are very expensive but when the quantities of any individual part are large enough to amortize the die cost, manufacturing costs are greatly reduced.

4. Barrel finishing equipment, installed in the shop, has eliminated a major portion of the hand burring and finishing operation, which is a tedious and time-consuming job. Among the advantages are:

lower cost per pc
absolutely uniform processing of close-tolerance parts
fewer personnel required
close control of metal removal
close control for uniform surface microfinish

For example, a fan-wheel that formerly cost $3.56 to burr and finish by hand now costs only $0.27. At this rate the equipment pays for itself in processing less than 1500 pieces.

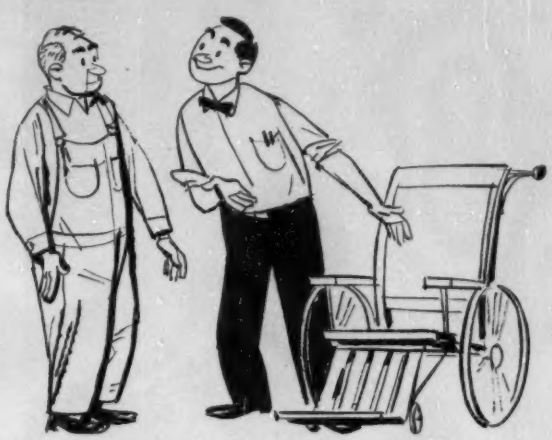
5. Sintered steel blanks, impregnated with copper, can be machined much more readily than wrought steel alloys, yet will withstand temperatures above 750 F. Thus, production can be increased many times and equipment designed to work aluminum can be used.

6. Reinforced plastics are used to manufacture several components in Stratos' products. The result is lower weight, reduced manufacturing cost, and conservation of metal. Also, several metal-forming machines are relieved for other work. (The value of the weight saved is multiplied when it is considered that every pound saved in equipment can lower the final aircraft weight by as much as 11 pounds.)

7. Titanium is being worked on an experimental basis to develop techniques for the day when even higher-temperature strength is required.

Round Table

Out the Back Door



"Say, Al; what did Harrison say to you the other day about Don Black?"

"Not a thing, Ed. Why?"

"Well, we were talking about Black's retirement, and I thought he was going to speak to you about it."

"He didn't say anything, Ed. All I know is that Black is almost 65, and company policy is to retire at that age. I suppose he'll be leaving us when his birthday rolls around."

"That's the trouble, Al. It doesn't seem fair to me. Black's a good worker; you know he used to work in my department before he went into yours. I've always hoped they could keep him on."

"He gets a pension, doesn't he?"

"Sure, but that's peanuts, and you know it. Actually, I think he could get along financially, but the thing that worries me is that he's one of these regular workers—never late, never off. If he had to quit working, it would kill him."

"Well, as far as I'm concerned, he's OK; but we really should stick to company practice. If it says he has to retire, well then he has to. Maybe he can find a hobby to keep himself busy with."

"Nuts to that, Al. The only hobby he has is his work. I just want to see if the company can't make an exception to the rule about retirements."

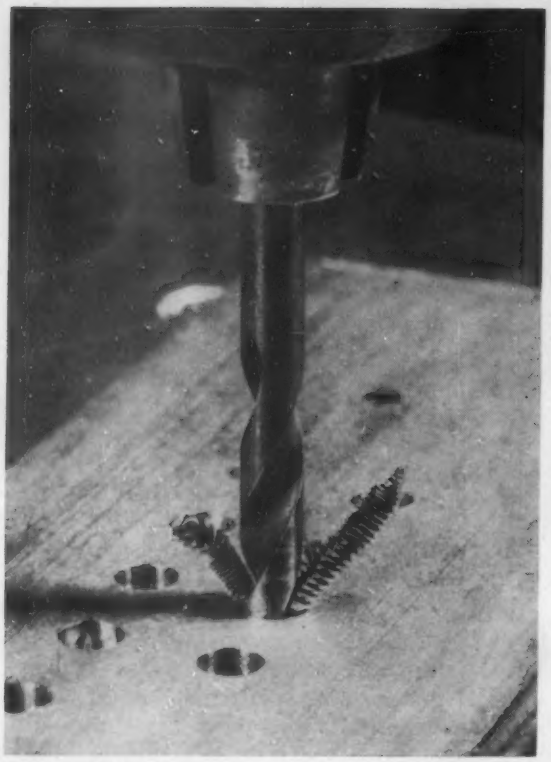
"I don't think an exception should be made, Ed. After all, it has been determined that after 65 a man's efficiency drops fast. It's just a matter of sticking to a rule. If we don't, everyone who gets near 65 will try to get an extension, and we'll soon have a shop of graybeards."

"Not at all, Al. A lot of old workers are eager to retire. Many of them only hang on the last few years because they want full retirement pay. I don't think one exception would cause any trouble. After all, if the company wants to keep a management man on after 65, there isn't any trouble."

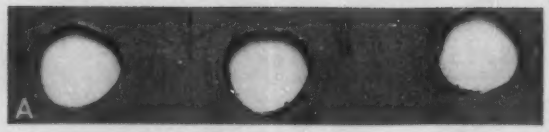
"Well, there isn't any contract with a management man, but there is with the shop, and if we keep on an old-timer past 65 we might be asking for trouble later."

"You can't prove a thing, Al. You're just worried about something you can't even pin down."

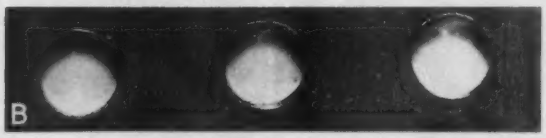
***IS FORCED** retirement at 65 a good practice, or should each company judge each case individually? Do workers drop off in value after 65, or is their efficiency just as good as a 64-year-old worker? Your opinions on the subject may help guide others. Discussions of earlier topics appear on later pages.*



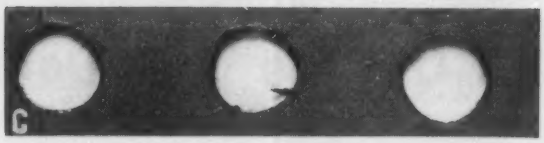
DRILLING TITANIUM SHEET at 485 rpm with uncleared 5/16-in. dia drill, especially ground, produces a *round* hole and a good continuous chip. Cutting is done dry. Black oxide finish on drill body provides lubricity; prevents galling and pick-up of titanium



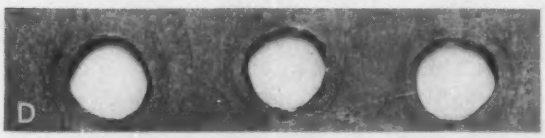
ROUGH, TRIANGULAR HOLES are typical of conventional drilling in titanium alloys. These holes are result with No. 5 cobalt-steel, polished-flute drill having 135° split point. Material is 0.040-in. thick RC-130A



0.090-IN. THICK RC-130A SHEET, otherwise same as "A"



CONVENTIONAL NO. 5 DRILL with 118° inc angle produced these holes in 0.040-in.-thick RC-130A



CONVENTIONAL HEAVY-DUTY SPIRAL-FLUTE drill (No. 5) with 135° inc angle produced these holes in 0.090-in. thick RC-130A

True-round holes...accurate hole size...

much longer drill life...reduced operator fatigue, with...

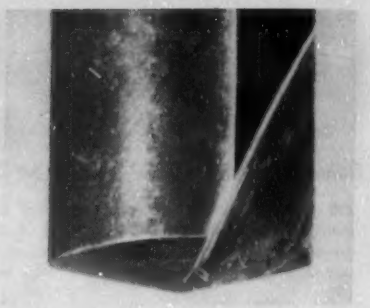
Republic Aviation Corp, Farmingdale, NY, realized two years ago that it would be faced with the problem of drilling titanium in production. No satisfactory method was available. The Manufacturing Research and Development Section decided to take this problem as a project. Result: A new drill design that, using portable power drills and cutting dry, produces 200 holes per drill grind, round and accurate, instead of the original five or six holes per grind, all triangular.

Drilling is only one of many problems in the use of titanium as a manufacturing material but, as with many other materials, drilling is one of the more difficult operations. When hand-held portable tools are used and, therefore, cutting must be done without coolant, the difficulty is compounded. With conventional methods, the resulting holes are usually triangular instead of round, drill life is extremely short, and the constant "push" required to make the drill cut causes rapid operator fatigue. Early attempts at hole production with conventional drills showed:

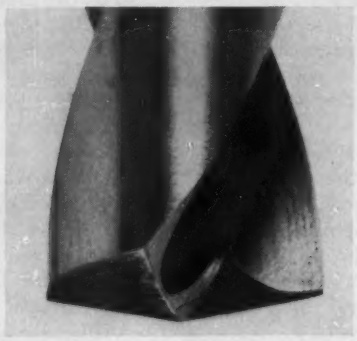
1. Drill failure after very few holes (frequently from 3 to 6). The excessive heat generated caused the drills and the material to overheat. Titanium chips welded onto the drill; caused rapid drill failure and very rough holes.
2. Holes were not round. They frequently devel-

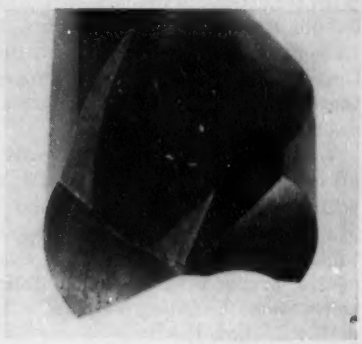
TITANIUM PICK-UP on conventional drill appears on land and heavily at cutting edge. Latter is probably result of high pressure (and temperature) required to obtain penetration . . .

UNCLEARED DRILL BODY, properly ground and polished but without black-oxide finish, shows smearing on land; very little pick-up at cutting edge



STRAIGHT-FLUTE DRILL is equally satisfactory with this grind; was original drill used to develop this grind. Then spiral-flute was developed for standardization.





RECOMMENDED DRILL GRIND is shown on this spiral drill. Body is uncleared and black oxide finished. Note that cutting edges meet at center; that chisel point is eliminated

New drill angles for titanium

oped a triangular shape or were extremely rough.

3. The excessive pressure required to force the drill into the material made portable drilling highly impractical.

4. Reaming, or opening holes to a larger size, was extremely difficult after pilot holes had been drilled.

Manufacturing research engineers at RAC evolved, through a comprehensive research program, an entirely new drill design. The first drill was made by Chicago-Latrobe. Drill dimensions and angles are extremely critical; require careful attention to detail and good toolmaking. But the result is worth the effort.

Specifications for the new drill include:

1. Short-length straight- or spiral-flute with heavy web, to insure maximum rigidity.

2. At least 150° included angle on point, to keep as much as possible of the drill body in the material.

3. No body clearance. On sheetmetal, the margin on the land picks up titanium. Also, because of the clearance, holes are permitted to go out of round. A straight cylindrical grind gives the drill enough support in the material to keep the hole round. Secondly, perhaps because unit pressure is reduced as the area of contact is increased, galling and pick-up are inhibited.

4. Zero-degree rake-angle has, thus far, given the best result. Negative rake causes excessive pressure and too much rake causes a breakdown on the lips at the drill periphery.

5. Web must be cleared to the *exact center* of the drill, so that *no chisel point remains.* This is a very important factor in reducing the amount of cutting pressure required. Ground thus, the drill is cutting all the way to the center, leaving no chisel point to be forced into the center and an absolute minimum

200 GOOD HOLES PER DRILL are result with RAC-designed drill point. Compare these holes with those shown in the other photographs. Holes up to two diameters deep have been successfully drilled

of material to be extruded from the center. Drills must be machine ground in a special setup.

6. Both cutting lips are in one line—meeting exactly at the center. (The two lips form a diameter.) With conventional drills, the cutting lips are offset—do not radiate from the center. Because titanium strongly resists entry of the cutting edge, it is believed that this offset provides moments which force the drill off center, thus produces holes which are not round.

7. Generated lip clearance will insure clearance all of the way to the center and, at the same time, will give proper support behind the cutting edge at the periphery. Generating setup is shown in drawings. Because both lips meet exactly at the drill center, proper lip clearance is difficult to achieve by conventional grinding methods. (Careful study of the drill will show the truth of this statement.)

As shown, the land on the end of the drill is a surface generated by an infinite number of straight radial lines, starting at a helix which is described on the drill body, and converging to the point—drill dead center. Each line successively further from the lip becomes an element of a cone with a proportionally smaller angle at the apex. This construction produces a surface which recedes at a constant rate from the surface of the cone created by the two cutting lips. Thus, positive clearance from the edge to the center of the drill is assured. Present feeling is that a helix angle of 15° from a perpendicular to the drill axis will give satisfactory results.

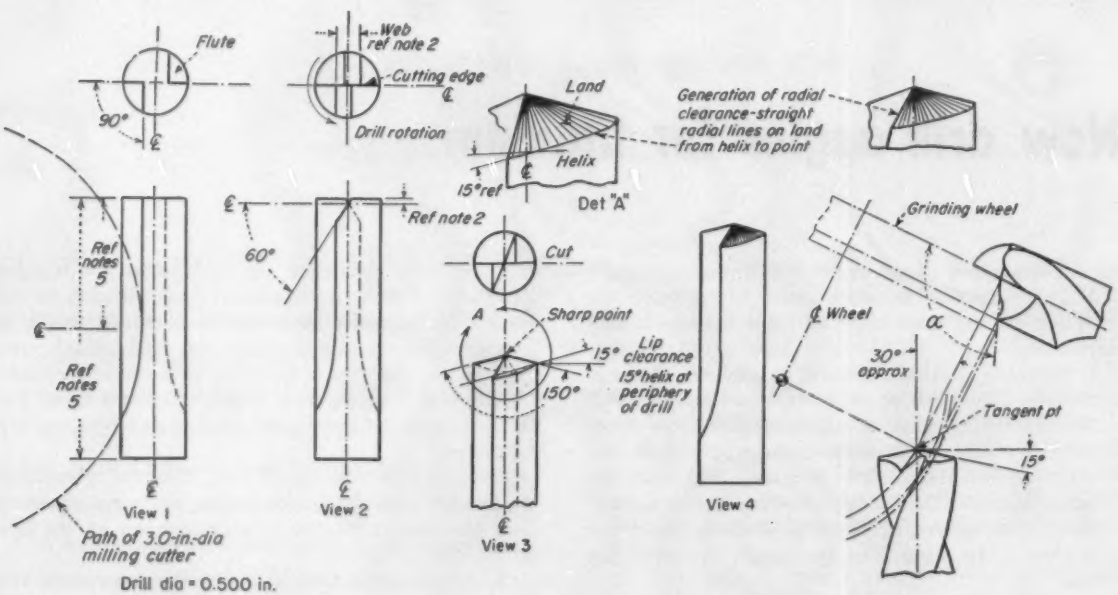
After testing and proving the adequacy of the basic design on straight-flute drills, it was applied to standard spiral-flute drills. Results were excellent. This point is readily adaptable to the spiral-flute drill. Further, in the interest of standardization, the schedule for standard screw-machine-length drills has been adopted.

Slow drilling speed is essential. Most tests were conducted at 485 to 500 rpm for drills from No. 40 through 5/16-in. dia.

Tests were carried out on both a hand-feed drill-press and a 500 rpm portable drill.

No lubricant was used on sheetmetal. For drilling bar stock, either "Dypral" tapping compound or liquid wax was used. While tests on bar stock were not sufficiently extensive to furnish conclusive answers at this time as to lubricants, feeds, speeds, etc, the use of a lubricant does seem to improve cutting and tool life. Dry drilling up to two diameters has proved practical.

Drill material M-10 (properly heat-treated) provided the best result. It is felt that correct grinding of the point is a much more important factor than is the actual analysis of steel—provided a good grade of high-speed steel is used.

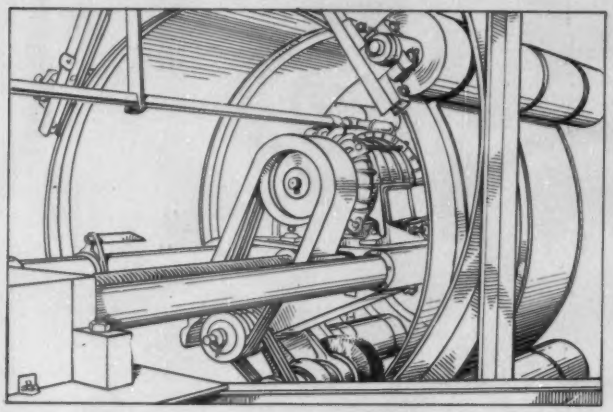


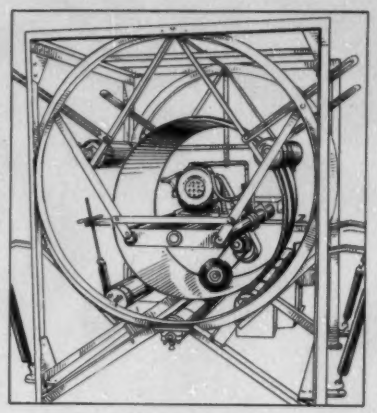
NOTES

1. *To determine web thickness, multiply drill diameter by 0.364 (straight-flute drill only.)*
2. *Sufficient stock to be left for cutting-edge grind.*
3. *All surfaces in contact with work to be black-oxide finished.*
4. *Drills to have no body clearance.*
5. *Drill over-all length & flute length to conform to standards for screw-machine short-length drills.*
6. *Rake angle to be 0° on both straight & spiral-flute drills.*

SETUP FOR GRINDING STRAIGHT AND SPIRAL-FLUTE DRILLS

Practical Ideas . . .





Automatic Polishing Machine

Among the parts made by one food machinery manufacturer is a series of stainless sheet steel cylindrical vats. Drum diameters vary from about 4 to 6 ft, with lengths varying in about the same proportions. The drums are made by wrapping the sheet steel to form an open-ended cylinder, and the joint is butt-welded. It is necessary that the interior surfaces of the drums be polished to a high finish.

Polishing was done by men working inside the shells, using portable power tools fitted with flexible sanding disks and abrasive-charged brushes. It took a man two or three days to produce the required finish inside the average drum. The work was tiring, because of the cramped space and heavy pressure required. To save time and energy, a power-polishing machine was designed and built.

One machine will handle all drums within the manufacturer's range of sizes. Principle of the machine is to revolve a drum while an 8-in. circular brush (powered by a 3 hp motor) is revolved in contact with the inside of the shell. At the same time, the brush is traversed slowly along the axis of the drum, so the brush path along the surface is a fine helix. The result is that a drum can be polished in three passes, with total time of about three hours, instead of three days. The finish is better and more uniform, too.

The machine frame is a bridge-like structure of bolted angle or L-section steel, with a large ring at each end. At the bottom of the drum are three closely spaced rollers which support the shell against the pressure of the brush. The two outer rollers are idlers, while the center one is powered, and rotates the shell. The upper rollers support the shell and hold it firmly in contact with the bottom rollers.

The top rollers pivot at the top center of the framework, and are adjustable for shells of different diameters, as are the two idlers at the bottom of the shell.

To give added support to the drums, rings of L-section steel are placed on the outside of the drums before mounting them in the machine. The rollers are grooved to accommodate the support rings, which are not fastened to the drum, and so can be reused.

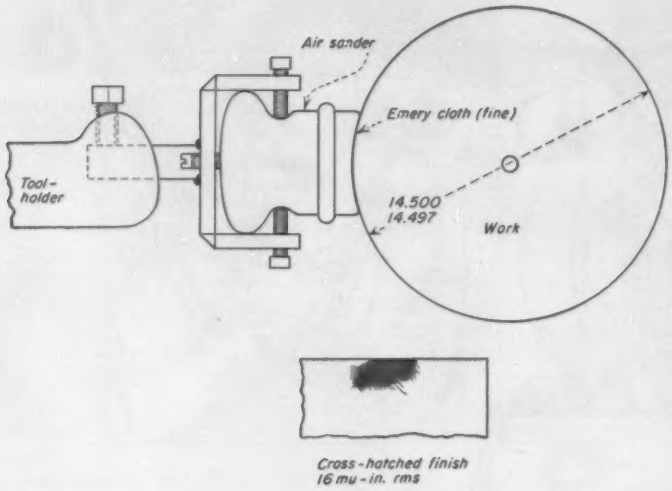
The brush carriage travels axially through the drum on two circular slide bars which are supported at one end in a cross-bar suspended from links anchored to the front framework ring. Between the slide bars is the feedscrew which traverses the brush. This screw engages with a nut integral with the carriage, and derives its rotation from the gearing in the casing. The casing holds a motor and speed reduction gear to drive the screw and bottom roller.

The polishing-head motor is mounted on the carriage and drives the brush through triple V-belts. Current for this motor is conveyed through cables within travelling conduit.

Trip-switches reverse the direction of brush travel at each end of the drum. *F E Riley, London, England*

Erasers Support Thin Parallels

When very thin-walled bushings must be held in a vise and supported over thin parallels, it is hard to get the parallels to stay in place while the bushings are gripped in the vise. Avoid this problem by putting an eraser or similar piece of rubber at each end of the parallels, and closing the vise so the rubber piece supports the parallels in place while the work is gripped. *Federico Strasser, Santiago, Chile*



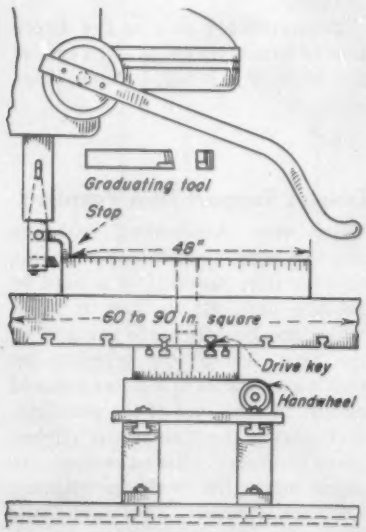
Cross-hatched finish 16 mu-in. rms

Toolpost-Mounted Air Sander Burnishes Hydraulic Ram

We were confronted with the problem of getting a 20 mu-in. rms finish on a hydraulic ram which was 14½ in. OD, 10½ ft, long. We didn't have a cylindrical grinder big enough to handle the job, so we did the job on a 50-in. lathe.

After finish-turning the ram with a single-point tool, we burnished the OD with a burnishing tool in the toolpost, supporting the work with follower-rest. The next step was to rig a commercially available reciprocating air sander in a standard toolholder, with a specially designed adapter.

With the aid of emery cloth and honing oil, we were able to get a 16 mu-in. rms cross-hatched finish. *John T Zurlo, Champlain, NY*



Radial Drill Graduates Table

We could graduate a circular table 48 in. in diameter on our milling machine, but when a square top was added to the table, the corners wouldn't clear the machine.

To do the job, we mounted the work on a 24-in. geared head rotary table, centering the two tables with a plug, and placed these tables on the bed of a radial drill.

To cut the graduations, we made a double-pointed grooving tool, to fit the spindle of the drill. The tool was stepped, so that one long and one short groove would be cut with each stroke of the (locked) spindle.

One turn of the handwheel on the rotary table turns the work 1°. *W J Green, Winter Park, Fla*

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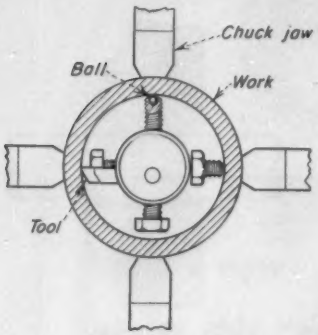
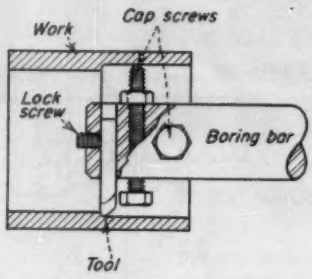




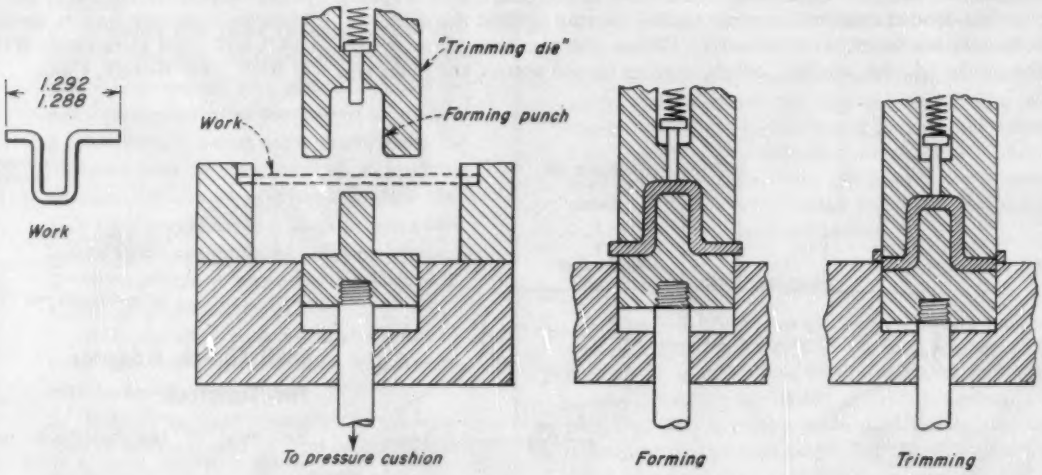
Internal "Steadyrest" Cuts Boring Bar Chatter

Simple and effective prevention of chatter of boring bars is easily achieved with this device. Drill and tap the boring bar, making two holes at right angles to each other, as shown.

Capscrews are inserted in these holes, adjusted to depth so the ends of the screws just touch the bore being cut. Locknuts prevent the screws from becoming loose during the cut.

Two methods can be used to prevent scoring of the interior of the bore. First, one end of each of the setcrews can be counterbored, with steel balls inserted and swaged or peened into place. Second, bronze tips can be welded onto the end of the screws, beveling the ends of the screws, to clear the threads. Then smooth the ends of these bronze tips to form a semicircular riding surface. This can be done by chucking the screws and turning a radius on the bronze tip.

This device will often prove to be a "chatter-buster" of great efficiency. *H J Gerber, Stillwater, Okla*



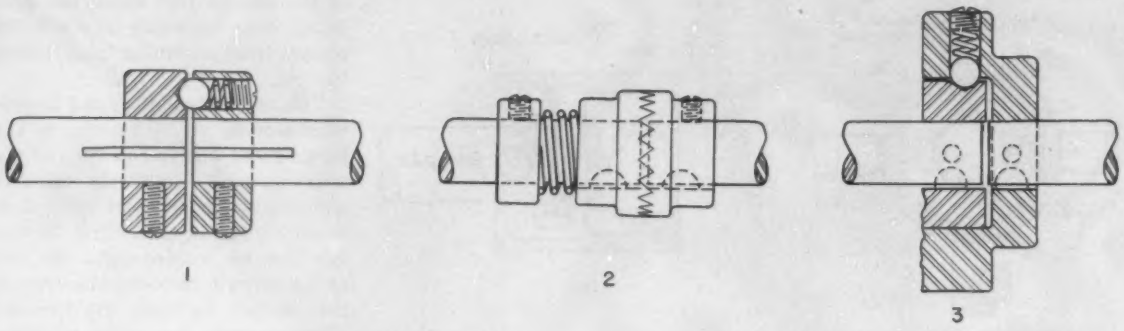
Simple Wire-Bending Die

We recently needed a piece of copper wire 0.090 in. diameter, to be formed as shown. Experimenting with dies of conventional design, we found we couldn't hold ± 0.002 in. tolerance on the dimension shown. This was true in spite of extreme care, because of non-uniform behavior of tool and material.

To get around the problem, we made the combination bending and trimming die shown.

Here is how the die works. Between the two stops we put a piece of wire about 0.100 in. longer than finished size. The ram descends, and the forming punch pushes the lateral parts of the wire around the forming block. As the ram continues downward, the outer edges of the forming punch act as a trimming die, cutting away excess material.

For quick ejection, the tool has a spring-actuated ejector incorporated in the body of the forming die. *Federico Strasser, Santiago, Chile*



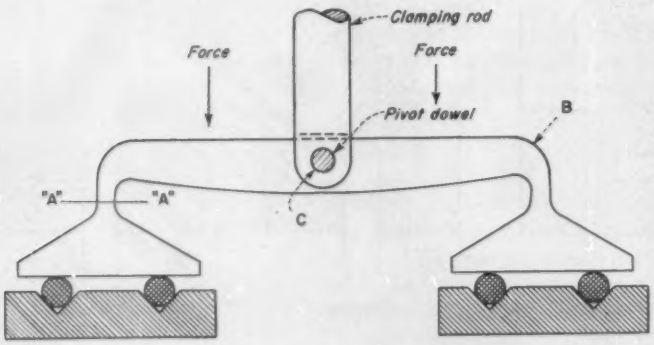
Devices Eliminate Shear Pins

When building machinery, where there is a hazard of jamming, these devices will eliminate shear pins, with their nuisance of replacement.

When shafts are provided with flanges for shear pins, one of several devices can be substituted. One consists of two flanges with a hardened spring-loaded steel ball or pin. Both flanges are keyed and locked to the ends of the shafts, with spring pressure against the ball end. In the second mechanism, a pair of serrated disks is employed. One disk is keyed and locked to the shaft. The other disk is keyed and allowed to slide back and forth on the shaft. An adjustable collar is fastened to this shaft, with a spring under tension against the disk.

When the machine jams, or excessive torque occurs, the disks slip on each other until the obstruction is removed. Then the machine can be started again. When end thrust is objectionable, a peripheral ball drive may be used.

When using the ball devices, if one ball is used, the shaft will always start from the same position. If more than one ball is used, the shaft will start at random. *William C Betz, New Britain, Conn*



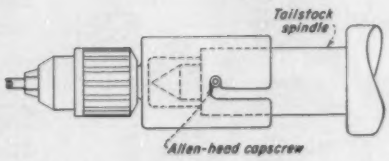
Equalizing Clamp For Light Work

Equalizing action between the two sides of this clamping fixture simplifies holding small workpieces of fairly uniform diameter.

When force is applied to the clamping rod, the strap floats on a pivot dowel. Therefore, more or less equal force is applied to all four points being held accurately.

To make this device effective, the section through "A-A" should be light enough to flex slightly under load, although strong enough to withstand clamping pressure.

This method has been successfully used on parts that are fairly uniform in diameter. If this condition does not exist, clamp distortion will be too great. *Cliff Bossmann, Dayton, Ohio*



Drill Chuck Adapter For Tailstock

Removal of the tailstock center when working with a drill chuck in the tailstock is avoided with this adapter. Instead of putting the chuck in the tailstock, an adapter is made which fits over the tailstock spindle. A setscrew fits a slot cut into the adapter, much like a bayonet socket, and holds the chuck from turning.

If it becomes necessary to remove the tailstock, which will not be needed as often with this device, the setscrew can be taken out easily, so the tailstock can be withdrawn to knock out the center. *P L Budwitz, New Britain, Conn*

American Machinist
SPECIAL REPORT
NUMBER 367

An

ERNEST WILDHABER, gear consultant, ROCHESTER, NY

Many questions about wormgear hobbing have not had satisfactory mathematical answers, for instance:
1.. What changes occur on the surface of a wormgear tooth when after sharpening the hob becomes smaller in diameter and is used at a decreased center distance?
2.. In that case, how can the correct hob-setting angle be determined?
3.. Just what can be accomplished by hob oversize towards improving contact conditions?

No one is known to have presented solutions to the three-dimensional problems involved in such questions. Presumably, equations for the surfaces of individual worms, gears, and hobs could be devised; but they would be disappointingly complicated and would require too much computation for practical use. A method based on surface curvature[1], however, has been developed by the author and used for many years in the field of bevel and hypoid gearing. The present discussion covers application to worms and wormgear hobs, and presents formulas comparatively short and sufficiently accurate. They allow us to see at once the meanings and effects of the important factors, both individually and in combination.

Worm-gearing contact

Let us see where our problems lie. Fig. 1 is a section of a cylindrical, helical worm in a plane perpendicular to its axis. One of the worm-thread profiles passes through pitch point O on the vertical center line. Fig. 2 is a partial section of the corresponding wormgear, shown separated from the worm, but in the same plane as Fig. 1, which here contains the gear axis. The vertical center line in both figures represents the common perpendicular of the worm and gear axes. Horizontal line OI is in the peripheral direction of the worm and parallel to the gear axis. Oblique line n through O is normal to the worm profile and inclined from OI at the transverse pressure angle ϕ_t, which is significant in connection with the behavior of oversize and undersize hobs. The profile normal n in these views along the worm axis is of course the projection to the section plane of the line in space normal to the thread surface.

[1]A paper, "Surface Curvature, a Tool for Engineers," was recently submitted by the author for presentation to the Industrial Mathematics Society of Detroit. It includes an extensive explanation of this method.

What's new about this "new look?"

1. It shows a simple new way to compute hob oversize, to attain eased-off tooth ends on the worm gear.
2. It shows in a simplified way just where ease-off is applied on the gear teeth and how it increases toward tooth ends.
3. It shows up changes that occur on gear teeth when, after sharpening, the hob shrinks in diameter and is used at a decreased center distance.
4. It shows that these changes do not depend on the hob diameter alone, and that with a large enough lead angle, a decrease of hob diameter increases the ease-off produced.
5. Not least, it points out a requirement in relieving hobs so they continue to produce the same pressure angle throughout their life. This requirement appears to have been overlooked in the conventional relieving process.
6. It goes beyond wormgear hobbing, and applies to all helical hobs.
7. While its effect is small in single-thread hobs with conventional gashes, it increases with increasing lead angles.
8. It shows up more when gashes with front rake or hook are used . . . and recognition of the defect is the first step towards a cure.

Just presented before the annual meeting of the American Gear Manufacturers Assn, this paper is a significant contribution. We are, therefore, presenting it here in its entirety, except for the derivation of mathematical proofs in a second appendix, which few readers will have the time to study thoroughly. Those who wish to do so may obtain the original paper by addressing the AGMA at 1 Thomas Circle, Washington 5, DC.

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new look at wormg

In the study of contact conditions in worm gearing, it has long been known that a helical worm has the same lines of contact with its gear whether it rotates about its axis or whether it is displaced in the axial direction without rotation. In the latter case it acts like a rack; and in Figs. 1 and 2 the line OI is the instantaneous axis of relative motion. This means that at any point of contact the normal intersects this axis. Points of contact between the thread surface and the conjugate gear-tooth surface lie on an inclined line i (Fig. 2) obtained by projecting the instantaneous axis OI along normals to the worm thread. This is the basic theory, but in practical gearing we often do not want fully conjugate surfaces.

Ease-off

I will use the term "ease-off" for what is also called mismatch, relief, modification, crowning, localized tooth bearing, etc.

Ease-off makes a worm and gear less sensitive to the small relative displacements that occur because of deflections and various inaccuracies. It means that there has been a slight removal of metal, in the form of a change of curvature, between contacting tooth surfaces that originally were exactly and fully conjugate. We can have profile ease-off at the tip and root of a profile, and we can at the same time have ease-off at the ends of a tooth.

If a worm and gear are painted with a marking compound and run together, the tooth bearing areas where contact occurs are wiped clean, and the effect of ease-off is at once seen. The tooth bearing obtained with a light load contains all the points that come into contact within very small limits of surface separation. For gears of say 6- to 10-in. dia, with smooth tooth surfaces, this limit of separation where marking ceases is known by observation and experience to be about 0.00025 in. It is somewhat more when the gears are larger. The effect of ease-off can be seen in the appearance of the tooth bearing, which fades out when the ease-off exceeds the marking limit.

Oversize hobs

We are particularly interested in the ease-off that occurs when the wormgear hob is oversize as compared with the worm. What we shall call the *basic oversize hob* is described thus: Its pitch diameter is slightly oversize, and it has the same normal pressure angle and the same normal base pitch (pitch in the direction normal to the thread surface). This requires the lead of the hob to be slightly less than that of the worm. The lead difference increases with the lead angle; and in single-thread hobs it may be almost negligible.

The effect of oversize will first be considered when there is no profile ease-off, that is when the hob and worm have corresponding normal profiles.

The amount of ease-off varies at different points; and as a way of describing it we may in imagination connect points of equal ease-off to obtain a system of lines, something like topographical lines on a map. This is shown in Fig. 3; and the effect is further illustrated in Figs. 4 and 5. Like Fig. 2 they are views looking at the tooth surface of the wormgear in the direction of the worm axis. These diagrams are simplified and conventionalized, to show the effect of oversize. Normal n is the same as in Fig. 2. The lines n′ of constant ease-off in Fig. 3 are parallel to n. There is one line of zero ease-off. This is line n itself; and the ease-off is central.

The amount of ease-off increases about as the square of the distance from n. Fig. 4 shows a central tooth bearing b following line n, as may be produced by hob oversize alone. Fig. 5 illustrates the ease-off for a tooth bearing placed at the leaving side of the worm thread. The ease-off varies in the same general way in the right and left directions.

Now, if we imagine making the hob diameter infinitely large, its thread surface would become flat, and the hob itself would become a rack. Then also the wormgear would become a helical gear; and the gear and worm would be a pair of helical gears on crossed axes. We know that in such a case there would be a single moving point of contact that would follow along line n in Fig. 4. And there would be only a narrow lane of tooth bearing on the gear tooth.

The effect of profile ease-off combined with oversize ease-off is illustrated in Fig. 6. The characteristic shape of the tooth bearing is then elliptical or oval. The full-line figure is in the central position, and the dotted-line figure shows a tooth bearing shifted to the leaving side on the gear tooth.

Going back to Fig. 3, the amount of ease-off because of oversize can be defined as the separation between meshing tooth surfaces at the lateral points Q and Q′

ear hobbing ...

FIG. 1 . . Section of cylindrical worm in pl
perpendicular to axis

on the horizontal line OI through the mean point O. During rotation, a point Q of the gear arrives at its nearest position to the surface of the worm thread, and then moves away again. Its minimum normal separation will be denoted by the letter symbol z, as appearing in the formula

$$z = C\,\Delta r$$

where Δr is the increase of the pitch radius of the hob over that of the worm. Here C is a constant that has the value expressed by the formula

$$C = \tfrac{1}{2}\left(\frac{F}{2\,r}\right)^2 \sin \phi_n$$

in which F is the face width of the gear, (2 r) is the worm pitch diameter, and ϕ_n is the normal pressure angle.

These two formulas give the amount of ease-off produced by the basic oversize hob at the ends of a gear tooth. With a central tooth bearing, the separation z computed by curvature is the same at both ends. As the curvature along a tooth is not constant, however, there will be some difference between the actual separations at the two ends, and the value z more closely represents the average. Also a slight shift of the tooth bearing from its central position could equalize the separations at the two ends.

Estimating the effect of tooth bearing position

In Fig. 7, the upper diagram illustrates symmetrical separations z, when the center of tooth contact is at point O. The lower diagram shows the center of tooth contact shifted to point O_e, towards the leaving side of the worm, as may be done by a slight change in hob setting angle. Then we have a separation z′ at Q which is at a distance x from O_e. We know that the separation between two curves in the vicinity of their point of tangency increases in proportion to the square of the distance from that point. Figuring with the same value of relative curvature

$$z' = \left(\frac{x}{F/2}\right)^2 z$$

If x equals 1.5 (F/2) as shown, $z' = 2.25\ z$.

It may be remarked that it is more accurate to figure z′ in this way, with the curvature at O which is intermediate between O_e and Q, than it would be to use the curvature at O_e.

In all cases, the separation at any given point depends on the position of the center of the tooth bearing (at O_e or O), which is estimated by eye, so it should also be allowable to use a simplified method of figuring.

Formula for ease-off resulting from oversize

The formula for z gives the ease-off as proportional to Δr, based on the difference of curvature at the mean point O. The proportion applies exactly for very small increases Δr of the hob radius, and is a satisfactory approximation for the small finite changes actually used. The formula may be said to give an exact solution to a simplified problem, but in spite of this simplification, its use is not a mere approximation in the conventional sense because it is not limited to a particular range of conditions. It applies to all lead angles, large or small, and to all pressure angles, to all kinds of helical threads, involute or non-involute, and to both hobs and fly-tools.

It should be noted that the formula does not even contain the lead angle, which may seem surprising. Yet it is true for all lead angles. And it takes into consideration not merely the change of the hob thread by oversize, but the effect on the wormgear surface.

Like all such formulas for gear generation, it rests of course on the assumption that the gear and hob are exactly timed together in the hobbing machine, and that the timing is not disturbed by the cutting loads.

Hob diameter change without lead change

When the hob is sharpened, its diameter decreases, but its lead is still the same as before. Figs. 8 and 9 are sections of a wormgear tooth and hob thread in the central plane of rotation of the gear. The points of contact are indicated. The convex hob profile shown suggests a substantial lead angle.

Fig. 8 shows the relation with the gear of a hob of *basic size*, either larger than or equal to the worm in diameter. Here the mean point O of the gear is in contact with the hob in the central position. There is also a dotted outline of a hob thread, as it would be after repeated sharpening. Point O′ of the latter cutting profile would also be expected to cut point O of the gear, with the hob set at a closer center distance.

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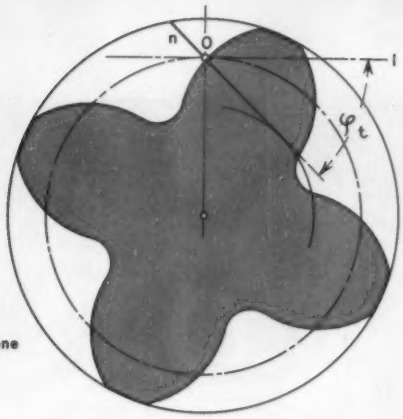


rm in plane

s to give the cutting profile at O′ the same inclina- (pressure angle) as at O, move it upward to O, change the angular setting of the hob in accord- e with the difference in lead angle at O and O′. this first idea is wrong; it seems right geomet- lly, but it is not right kinematically.

we let the hob have the same pressure angle at s at Q, then with the same lead it cannot have the e normal base pitch (in the direction normal to surface). Unless it does have the same normal base h at O′, which means the same velocity component he direction normal to the surface, it cannot pos- y have kinematic contact with point O of the gear, re the normal is given.

ccordingly, the pressure angle at O′ must be ntly smaller than that at O to make the same nor- base pitch. The normal p′ at O′ is at a smaller sure angle than normal n. Then point O′ of the thread can make kinematic contact with point O he wormgear, but the position of contact must be ntly off-center to allow the surfaces to be tangent ach other. Fig. 9 shows this position. Point O has n rotated enough about the gear axis to make the sure angles of the two surfaces match. We then e point O′ of the hob in contact with point O of the at a position O_x offset from the line of centers.

the worm and hob threads are *involute* helicoids, hob thread surface after sharpening as shown by dotted outline should be identical with the surface re sharpening, as shown in full lines. The two s of an involute hob thread are merely moved ther axially as the diameter is decreased, but the aces remain as before, and the normal base pitch ains constant. Such an involute worm and hob, efore, would fulfill the kinematic requirements oints O′ and O.

all cases the pressure angle represented by the nation of the normal line should be slightly dif- nt at O′ from what it is at O. The difference is the e as would exist on the surface of an involute al thread. For comparison, Fig. 10 shows a hob straight profile. It has the same radius to O as nob of Fig. 8, the same normal at O, and the same At point O′ after sharpening, the surface normal ould be the same as in Fig. 8. These changes of nation can be controlled by the ways in which the is relief-ground and sharpened.

the kinematic requirement is not met, the effect

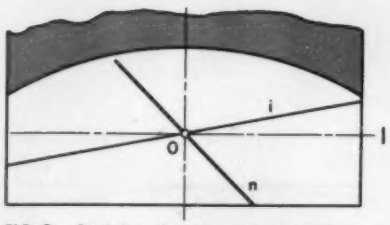


FIG. 2 . . Partial section of wormgear in plane containing axis and mean point of tooth surface

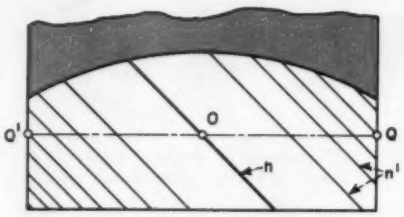


FIG. 3 . . Conventionalized diagram of wormgear tooth surface with lines of constant ease-off resulting from oversize hob

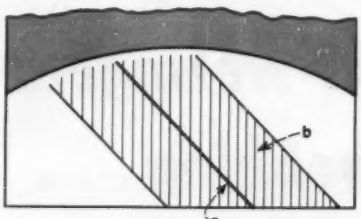


FIG. 4 . . Central tooth bearing as produced by oversize ease-off alone

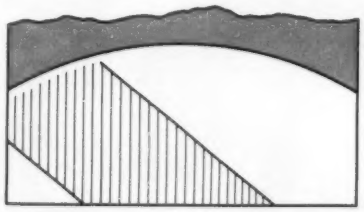


FIG. 5 . . Tooth bearing for oversize ease-off shifted in position towards leaving side of worm

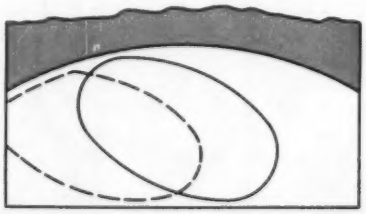


FIG. 6 . . Characteristic (and conventional) form of tooth bearing resulting from combined oversize ease-off and profile ease-off

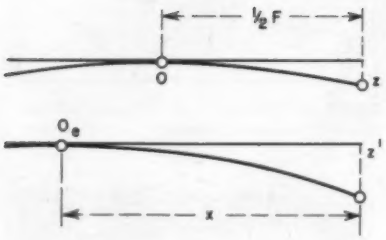


FIG. 7 . . Diagrams to illustrate way of estimating effect on ease-off of change in position of tooth bearing

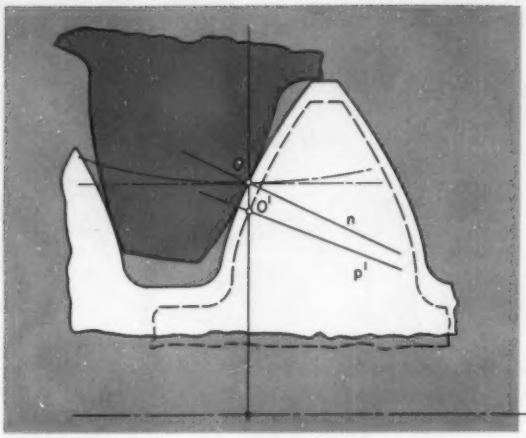


FIG. 8 . . Section showing gear and hob profiles in central plane of rotation of gear with contact at the pitch point, for basic oversize hob

A new look at wormgear hobbing . . .

CONTINUED

will be a tooth surface with a different normal at O, resulting in a slight variation from smooth motion between the worm and wormgear. It seems that this has at times been overlooked, and that only geometrical tangency was considered. For the small lead angles that are in such common use, the difference may not be noticeable. This probably accounts for the belief that a high lead angle is the cause of trouble when using hobs of changing diameter, and that the only way to obtain correct results is to keep to a fixed center distance.

Ease-off change

When we look at the gear tooth surface in the same way, we find that the hob thread of Fig. 9 lies on this surface in a different direction as compared with the hob thread of Fig. 8. The direction of the hob helix passing through O or O_x is not the same in the two contact positions[1]. The tooth shape of the gear produced at the offset contact position O_x depends on this changed direction as well as on the changed hob diameter.

The change in direction and the change of diameter are necessarily related, and one counteracts the other to some extent. The change in ease-off dz at the side points Q, Q' (Fig. 3) as derived by curvature is given by the equation

$$dz = C\,(1 - \text{ctn}^2\,\phi_t)\,dr$$

Here C is the same quantity as referred to previously, ϕ_t is the worm transverse pressure angle, and dr is the increase in the hob radius over the radius of the basic size hob. In Fig. 9, dr is actually a decrease, and should be used with a negative sign. Like z, dz is in the direction normal to the surface, and a positive value denotes an increase in ease-off. Changes of ease-off occur in the same way as described for the ease-off

[1]Considered further in Appendix B to the original paper.

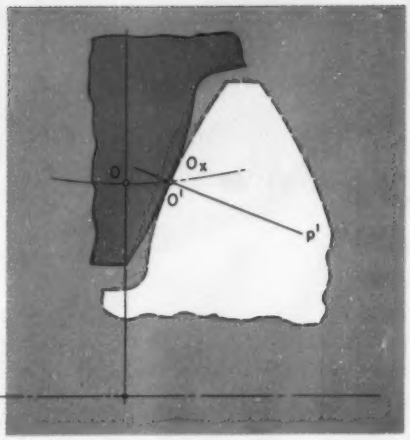


FIG. 9 . . Section similar to Fig. 8 but with point of contact displaced off center for hob of decreased size

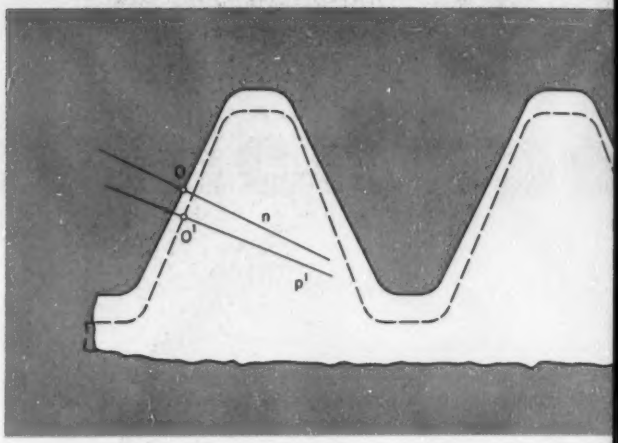


FIG. 10 . . Axial section of hob thread showing difference in direction of normals at pitch points for different hob diameters

itself in Fig. 3. Line n, Fig. 3, is a line of zero change, and the amount of change varies about as the square of the distance from that line.

We now have formulas, or equations, for two cases: the first for z, when the required normal base pitch in the hob is obtained by changing its lead; and the second for dz, when the lead remains unchanged and the pressure angle is changed instead. The difference between the equations is that the second contains the parenthesis

$$(1 - \text{ctn}^2\ \phi_t)$$

This factor decreases the ease-off change. For instance, with a normal pressure angle of 20° and a lead angle of 12°, the value of the parenthesis is 0.6737; and in such a case a given radial change not accompanied by a lead change gives an ease-off change only two-thirds as much as when there is also a lead change. And with the same pressure angle but with a lead angle of 21° 21′ the cotangent of the transverse pressure angle becomes unity. Then the value of the parenthesis is zero, and the ease-off is not affected by a change dr.

Thus we discover that with the transverse pressure angle 45° (cotangent = 1.0), a moderate change of hob radius will have practically no effect on ease-off.

At the same normal pressure angle of 20° and with a still larger lead angle, say 30°, *the smaller hob gives more ease-off than the larger one.* This may have been seen at some time, but it is contrary to what is ordinarily expected.

The equation just discussed is also an exact expression of *curvature* and applies to all lead angles and pressure angles. The hob is set to a center distance changed by dr, and the angular hob setting is changed. It will be shown later that the angular change should be larger than the change in lead angle.

Worm drives insensitive to variations in hob diameter

When the lead angle is 15° or more, it is possible to design worm drives in such a way that they will show no appreciable change in ease-off during the life of a hob. This is done by making the transverse pressure angle 45° or nearly that amount. Then

$$\tan \phi_n = \sin \lambda$$

At 15° lead angle, the normal pressure angle should be 14½°; and at 30° lead angle, the normal pressure angle figures 26° 34′. This does not have to be followed exactly.

Change of ease-off after hob is made

With lead angles from 12° up, it is possible to change the ease-off originally intended or expected in the hob design, by slightly altering the pressure angle and lead of the worm while keeping the same normal base pitch, and without changing worm diameter or center distance. To accomplish this we let the two hob radius changes Δr and dr (the first with a lead change and the second without) counteract each other.

An imaginary increase Δr in hob radius with change of lead would cause an increase in the ease-off separation

$$z_1 = C\ \Delta r,$$

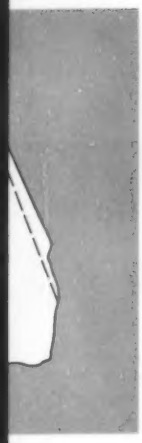
while an equal decrease with change of pressure angle would produce a change

$$z_2 = -C\ (1 - \text{ctn}^2\ \phi_t)\ \Delta r$$

The resulting increase in the separation would be

$$z_1 - z_2 = C\ \text{ctn}^2\ \phi_t\ \Delta r$$

The end result of this imaginary transformation would be the known existing hob. The worm would be changed slightly in lead and pressure angle. Further explanation about this and a numerical example are given as an appendix.



Appendix A . . . EXAMPLE OF EASE-OFF CONTROL AFTER HO

To increase the ease-off by 0.001 in the worm and gear of Example 1 without altering the hob or the gear, we first determine the imaginary increment Δr of hob radius. According to a previously derived equation

$$z_1 + z_2 = C \operatorname{ctn}^2 \phi_t \, \Delta r = 0.001$$

The numerical solution gives $\Delta r = -dr = 0.0187$

We go backwards through the steps previously outlined, starting with the final hob which is assumed the same as the basic hob. The numerical data are: $r' = 1.523$, normal pressure angle $\phi_n = 20°$, lead angle $\lambda' = 23° 37'$ corresponding to a lead L'.

Keeping the same lead and going to a larger radius with an increase $dr = 0.0187$, there is a new value of lead angle λ''

$$\tan \lambda'' = \frac{r'}{(r' + dr)} \tan \lambda' \, ; \, \lambda'' = 23° \, 21\tfrac{1}{2}'$$

Then the
normal base
determined

$$(r'$$

$$\cos \phi_n'' =$$

This same
initial hob d
also the nor
To retain
lead angle λ

$$\sin \lambda_x =$$

Equations and numerical examples

Notation

r	pitch radius of worm
Δr	change in radius (and center distance)
$r' = r + \Delta r$	pitch radius of basic oversize hob having the same normal pressure angle as the worm
dr	increment of hob pitch radius + or − from its basic size
L	lead of worm
L'	lead of oversize hob
F	face width of wormgear
λ	lead angle of worm
λ'	lead angle of oversize hob
ϕ_n	normal pressure angle (in plane normal to pitch helix at side of tooth)
ϕ_t	transverse pressure angle
Σ	hob angular setting
$\Delta\Sigma$, $d\Sigma$	changes in hob angular setting
z	ease-off separation in normal direction at ends of gear tooth, based on change of curvature, caused by basic oversize hob of pitch radius r'
dz	ease-off increment when pitch radius of hob is increased by dr without lead change
$z_t = z + dz$	total ease-off
z'	ease-off at a distance x from center of tooth bearing, x being measured in the direction of the gear axis
C	a factor relating ease-off to radial change

Equations

Known equations:

$$\sin \lambda' = \frac{r}{r'} \sin \lambda, \quad \text{(a)} \qquad L' = \frac{\cos \lambda}{\cos \lambda'} L; \qquad \text{(b)}$$

$$\Delta\Sigma = (\lambda - \lambda') \quad \text{(c)} \qquad \operatorname{ctn} \phi_t = \frac{\sin \lambda}{\tan \phi_n} \quad \text{(d)}$$

New equations:

$$C = \tfrac{1}{2} \left(\frac{F}{2r}\right)^2 \sin \phi_n \qquad (1)$$

$$z = C \, \Delta r; \; \Delta r = \frac{z}{C} \qquad (2)$$

$$dz = C \, (1 - \operatorname{ctn}^2 \phi_t) \, dr \qquad (3)$$

$$z_t = z + dz \qquad (4)$$

$$z' = \left(\frac{x}{F/2}\right)^2 z_t \qquad (5)$$

$$d\Sigma = 3438 \left(\frac{dr}{r}\right) \tan \lambda, \text{ minutes} \qquad (6)$$

(based on worm radius r)

$$d\Sigma = 3438 \left(\frac{dr}{r}\right) \tan \lambda \left(\frac{r}{r'}\right)^2, \text{ minutes} \qquad (6a)$$

(based on hob radius r')

$$\Sigma = \Delta\Sigma + d\Sigma \qquad (7)$$

Numerical examples *(linear dimensions in inches)*

Example 1: How much oversize should be provided? Let us assume the following specifications:

worm pitch radius r 1.5; lead angle 24°
normal pressure angle ϕ_n 20°; gear face width F 1.5

The hob is to be relieved to give a total radial change of 0.060 during its life. How much oversize is required so it will always produce some ease-off?

In this case the radial change of the hob over and below its basic size will be $dr = 0.030$.

We first determine the cotangent of the transverse pressure angle, and then determine dz.

$$\operatorname{ctn} \phi_t = \frac{\sin \lambda}{\tan \phi_n} = 1.1175; \; (1 - \operatorname{ctn}^2 \phi_t) = -0.2488$$

$$C = \tfrac{1}{2} \left(\frac{F}{2r}\right)^2 \sin \phi_n = 0.04275 \qquad (1)$$

$$dz = C \, (1 - \operatorname{ctn}^2 \phi_t) \, dr = 0.04274 \, (-0.2488) \cdot 0.030$$
$$= -0.00032 \qquad (3)$$

This gives us the change in ease-off between the basic hob size and the initial size for which

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Example 2:
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en the normal pressure angle ϕ_n'' to keep the same al base pitch as in the worm and the basic hob is mined as follows:

$$(r' + dr) \sin \lambda'' \cos \phi_n'' = r \sin \lambda \cos \phi_n$$

$$\phi_n'' = \frac{r \sin \lambda}{(r' + dr) \sin \lambda''} \cos \phi_n \text{ ; thus } \phi_n'' = 20° 18' 10''$$

s same pressure angle is kept when we go back to the l hob diameter, this time with a change in lead. It is he normal pressure angle of the new worm.

retain the same normal base pitch as always, a new angle λ_x in the worm is required, figured thus:

$$\sin \lambda_x \cos \phi_n'' = \sin \lambda \cos \phi_n$$

$$\sin \lambda_x = \frac{\cos \phi_n}{\cos \phi_n''} \sin \lambda \text{ , from which } \lambda_x = 24° 2' 58''$$

Having the lead angle, the new lead for the worm can be found as

$$L_x = 2 \pi r \tan \lambda_x$$

The change in thread thickness is usually negligible.

The two changes for the hob setting angle, for $+ \Delta r$ and $dr = - \Delta r$, are found to cancel each other, so that the setting of the hob can remain as before. In other words no change in the wormgear is required. The increase in ease-off is accomplished by the change in pressure angle combined with the change of lead in the worm.

We have considered here an increase in ease-off. The opposite steps will effect a decrease.

As ease-off changes of this kind are estimated by the proportions of infinitesimal changes at the mean point, it is recommended that in this procedure we do not make the value $\Delta r = - dr$ greater than about 3% of r

$+ 0.030$. The negative sign in the result indicates the *larger* hob produces *less* ease-off.

w if we choose the basic hob size to produce an -off of $z = 0.0010$, we will get the following nts during the hob life (based on a central tooth ng):

ew hob	$dr = + 0.030$	$(z + dz) = 0.0007$	
asic oversize hob	$dr = 0$	$z = 0.0010$	
sed-up hob	$dr = -0.030$	$(z - dz) = 0.0013$	

is is the ease-off at the end points Q, Q′ of a gear , based on curvature computation. Midway be- n the central plane and the tooth ends, a distance ½ (F/2) from the center of the tooth bearing, ease-off is one quarter of the above amounts, as by formula (5).

e radial increment of the basic oversize hob, 0.0010, should be

$$\Delta r = \frac{z}{C} = 0.023 \qquad (2)$$

e may want to know the angular setting in the ing machine as the hob size changes. At the basic radius of 1.523, the lead angle changes from 24° to $\lambda' = 23° 37'$, using equations (a), (b), (c). he basic hob size, therefore, the setting angle is nutes. This is made in the direction that increases helix angle of the gear. Then for the change of corresponding to the radial increment $dr = 0.030$ without lead change, we use equation (6a) and n $d\Sigma = 30'$ (minutes)

e resulting figures are

new hob	$dr = +0.030$	$\Delta\Sigma + d\Sigma = 53'$
used-up hob	$dr = -0.030$	$\Delta\Sigma + d\Sigma = - 7'$

the same time the center distance is increased $\Delta r + dr$).

w that a way of obtaining these figures is avail- they may be helpful on the hobbing machine.

nple 2: Hob with smaller lead angle. If we keep ame specifications as in example 1 except chang- ing the lead angle from 24° to 12°, how much total change of ease-off will occur, for 2 dr = 0.060?

We first note that there is now a different transverse pressure angle. Allowing for this, equation (3) gives

$$dz = C (1 - \text{ctn}^2 \phi_t) \, dr = 0.04275 \cdot 0.6737 \cdot 0.030 = 0.00086$$

This is half the total change.

Then if we make the basic oversize hob for $z = 0.0020$, the following figures result:

for new hob	$dr = +0.030$	$(z + dz) = 0.0029$
for used-up hob	$dr = -0.030$	$(z - dz) = 0.0011$

Example 3: Ease-off with non-central tooth bearing. Suppose that we take the case of Example 2, and decide to shift the bearing to the leaving side with its center halfway between the central plane and the end of the gear tooth. How large is the separation (z′) at the entering side, with the basic size of the hob?

Referring to equation (5), $x = 1.5 (F/2)$ and

$$z' = (1.5)^2 z = 0.0045$$

All these computations are simple enough to be performed with a sliderule.

Conclusion

Equations presented can readily be applied in design of worms and wormgear hobs. They show in the most direct way the effects on ease-off of the principal factors in the design, namely: lead angle, pressure angle, face width, and hob oversize.

These equations are the result of a mathematical treatment based on surface curvatures. Derivation of the equations is outlined in an appendix. The appendix also contains an example to show how ease-off can be altered even when the wormgear has already been hobbed, by changes made in the worm while still keeping the same diameter and center distance.

I wish to acknowledge the advice and assistance of my old-time associate, Allan H Candee, in selecting and preparing this new information on wormgear hobbing.

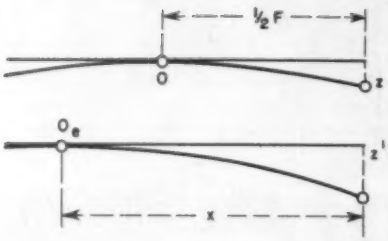
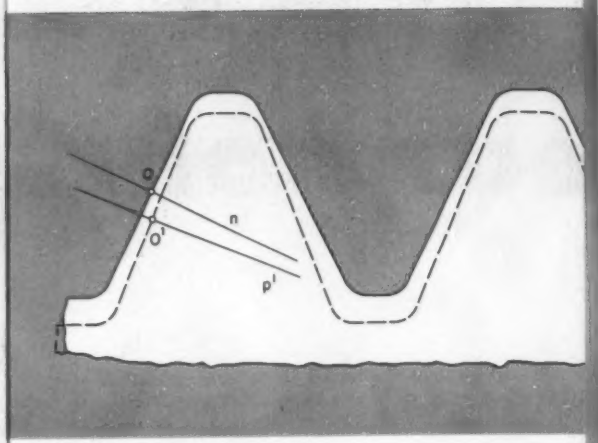


FIG. 7 . . Diagrams to illustrate way of estimating effect on ease-off of change in position of tooth bearing



10 . . Axial section of hob thread ing difference in direction of normals itch points for different hob diameters

A new look at wormgear hobbing . . .

CONTINUED

Worm drives insensitive to variations in hob diameter

When the lead angle is 15° or more, it is possible to design worm drives in such a way that they will show no appreciable change in ease-off during the life of a hob. This is done by making the transverse pressure angle 45° or nearly that amount. Then

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while an equal decrease with change of pressure angle would produce a change

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The resulting increase in the separation would be

$$z_1 + z_2 = C\,\text{ctn}^2\,\phi_t\,\Delta r$$

The end result of this imaginary transformation would be the known existing hob. The worm would be changed slightly in lead and pressure angle. Further explanation about this and a numerical example are given as an appendix.

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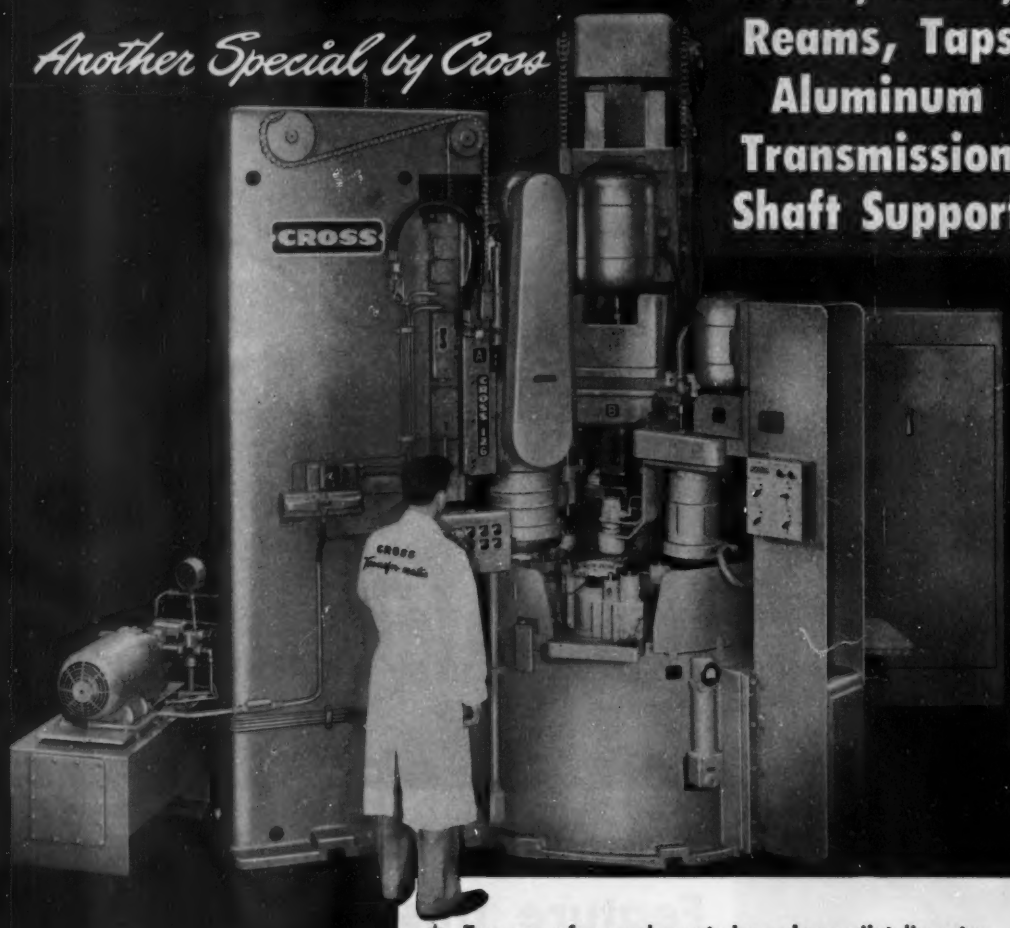

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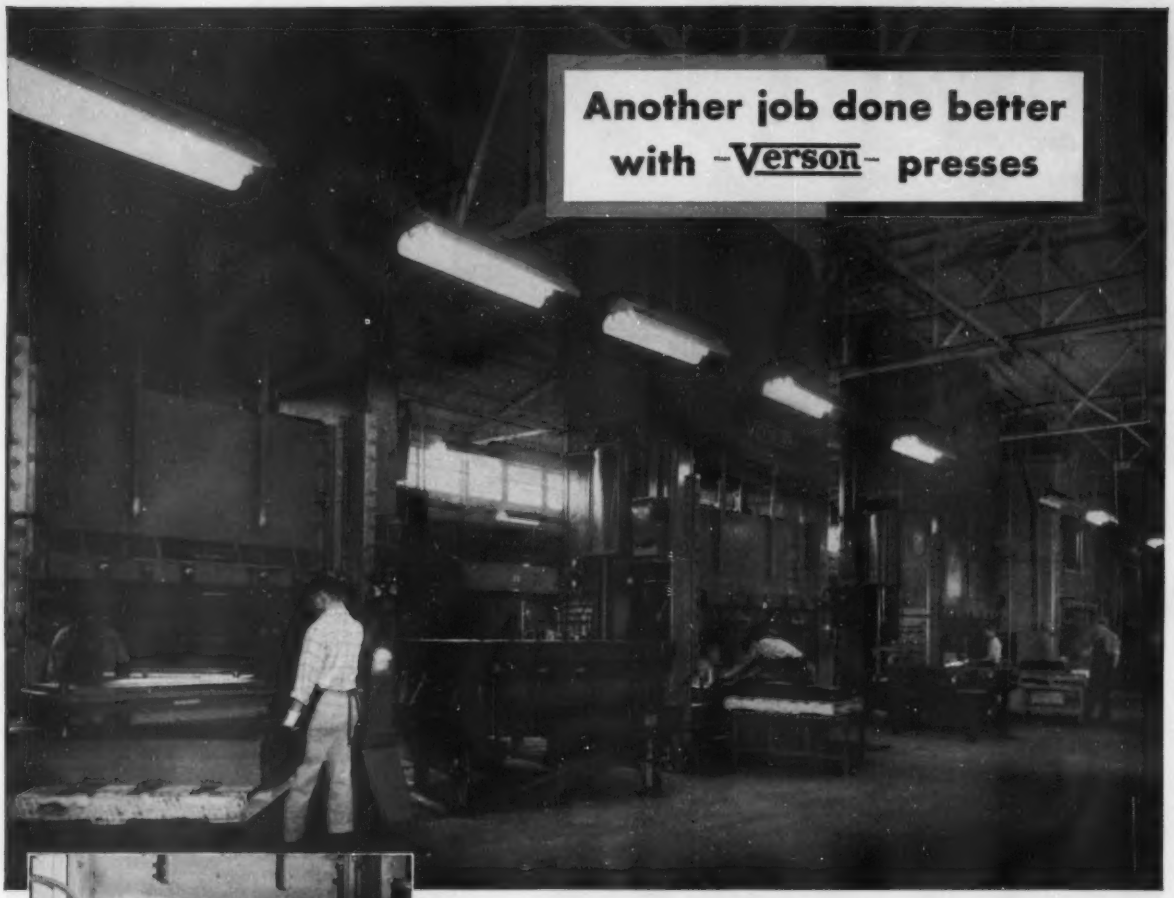

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Reasons for Carbide-Tool Failure . . .

W L KENNICOTT, chief engineer, KENNAMETAL, INC, LATROBE, PENNA

Analyzing carbide-tool breakage is not difficult if you have the proper kit of tools and the right knowledge of how to look for clues. First, you need a good eraser to clean off dirt, a 10X or 16X glass to examine tool surfaces for cracks and checks, and a protractor for checking angles and straight edges. A small file is useful for testing shanks for hardness.

If you get repeated tool damage on a job, a careful analysis is definitely valuable; most causes of tool breakage can be found and corrected. There are four major reasons:

1. Improper tool design or selection
2. Improper tool preparation
3. Improper application
4. Machine-tool malfunction

There are unlimited variations on these themes, of course, so only a few characteristic examples, or case studies, can be shown. Here are sample failures, how they happened, and how they were corrected:

Crushed tip . . .

PROBLEM	SOLUTION	CORRECTION
Lathe bits failed at cutting points, as if from top overload	Carbide fragments driven down into braze and shank, then tilted forward, indicating downward shear (faulty design)	Flank relief and clearance reduced to provide more support under cutting point

Bent shank . . .

PROBLEM	SOLUTION	CORRECTION
Shank of counterboring tool bent and twisted at section ground down to clear work	Shank was SAE 1095, at R_c 25, apparently too soft for load and overhang (faulty specification)	Shank changed to air-hardening tool steel at R_c 45, which eliminated bending

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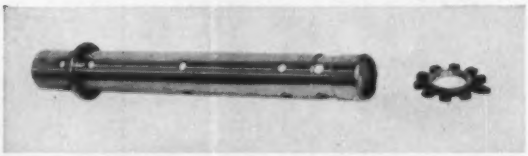

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Reasons for Carbide-Tool Failure . . . II

Broken shank . . .

PROBLEM	SOLUTION	CORRECTION
Brazed ¾-in.-sq tool ground down to ⅝ in. wide behind tip broke 1⅞ in. back; cutting edge spalled	Clean spalls show tool did not cut after shank broke; overhang caused failure (faulty selection)	Tool shank 1½ in. deep in suitable toolpost took load with overhang

Broken tips . . .

PROBLEM	SOLUTION	CORRECTION
Triangular bits broken across corners; useful life much reduced	Glass showed up heat checks which developed into cracks and finally breaks due to extreme dulling and cratering (faulty application)	Bits were indexed regularly before edges dulled excessively. Other solutions would be use of coolant more effectively or carbide grade with higher conductivity rate

Checking . . .

PROBLEM	SOLUTION	CORRECTION
Three carbide wear pads backing up trepanning bit checked severely and discolored from heat	Cutter clearance beyond wear-pad circle disappeared as bit wore, letting pads jam in bore and even halting machine (faulty design)	Only two wear pads were used to let head find its own center, thus preventing jamming and eliminating trouble

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7/16" to less than 1/2"	7.70	8.55				
1/2" to less than 9/16"	6.60	7.35				
9/16" to less than 5/8"	5.45	5.95				
5/8" to less than 11/16"	4.95	5.50				
11/16" to less than 13/16"	4.35	4.80				
13/16" to less than 15/16"	3.65	4.10				
15/16" to less than 1 1/8"	3.20	3.55	$4.80	$5.35	$2.25	$2.50
1 1/8" to less than 1 7/16"	2.50	2.80	3.90	4.45	1.70	1.90
1 7/16" to less than 1 15/16"	2.15	2.40	2.55	2.80	1.20	1.30
1 15/16" to less than 2 1/4"			2.45	2.65	1.15	1.25
2 1/4" to less than 2 15/16"			2.00	2.20	.70	.80
2 15/16" to less than 3 3/16"			1.90	2.10	.65	.75
3 3/16" to less than 3 13/16"			1.90	2.05	.60	.70
3 13/16" to less than 4 1/16"			2.20	2.35	.55	.65
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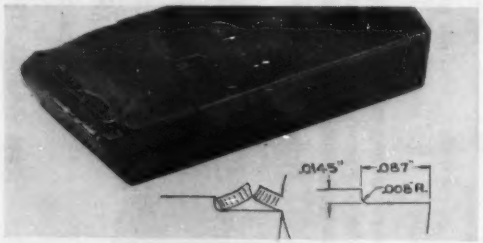
Reasons for Carbide-Tool Failure . . . III

Bits lost . . .

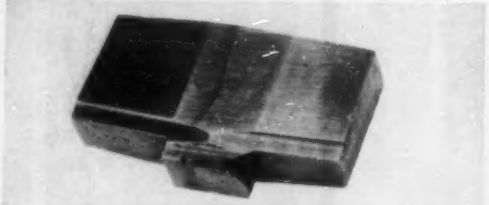
PROBLEM	SOLUTION	CORRECTION
Grooving tool with ¾- by 1¼-in. shank lost ¼-in. tips completely, ruining stainless rings	Dirt under tips showed poor cleaning practice; incomplete braze fusion and loose overflow indicated brazing heat was low (faulty preparation)	Improved cleaning and higher temperature for brazing cured the trouble

Chipbreaker . . .



PROBLEM	SOLUTION	CORRECTION
Boring-cutter blades chipped at cutting edges, spalled at shoulder of chipbreaker	Spalling indicated pressure from chips, which were jamming in breaker, causing chipping at cutting edge and shoulder (faulty preparation)	Chipbreaker grinding was changed to produce radius 1½ to 2 times breaker depth, letting chips flow evenly

Deep-hole drill . . .



PROBLEM	SOLUTION	CORRECTION
Trepanning-head tips for deep-hole drilling cracked back from cutting edges	Scalloped chipbreaker with heat checks showed under glass. Pressure or braze strain would have started cracks at corners (faulty preparation)	Better grinder and operator training eliminated grinding heat checks to stop complaints

NOW Cut Your Carbide Tooling Costs in Half!

See chart below to determine how much you can save.

New V-R Toolholder for "Throw-Away" blanks is available either with Negative Rake or Neutral Rake. Styles are available for triangular, square and round "Throw-Away" blanks.

with V-R Toolholders* and "Throw-Away" Blanks!

- No Chipbreaker Grinding
- Lower Tool Inventory
- Available with Negative or Neutral Rake
- No Carbide Grinding
- Cutting Edge Automatically Positioned
- Another Cutting Edge Quickly Available

More Economical Than Brazed Tools

Compare The Cost Per Cutting Edge...

The costs on a brazed tool's useable cutting edges are:

1. Original cost of the tool
2. Cost of each regrind
3. Number of regrinds obtainable

Formula for computing cost per cutting edge

$$\frac{\text{(Cost of Tool)} + \text{(No. of regrinds} \times \text{cost per grind)}}{\text{Number of regrinds} + 1 \text{ (for original tool)}} = \text{Cost per cutting edge}$$

Compute the cost per cutting edge for a typical brazed tool you use and compare it with cost per cutting edge of a "Throw-Away" blank!

V-R "Throw-Away" Blank Cost Per Cutting Edge

"Throw-Away" Blank Style and Size	Triangular				Square		Round	
	¼"IC	⅜"IC	½"IC	⅝"IC	⅜"sq	½"sq	⅜"	½"
Utility Class for NEGATIVE RAKE Type	.06	.10	.20	.33	.07	.15	..	..
UTILITY Class for NEUTRAL RAKE Type	.12	.20	.40	.66	.15	.30	..	..
PRECISION Class for NEGATIVE RAKE Type	.10	.17	.27	.42	.13	.23	.06	.11
PRECISION Class for NEUTRAL RAKE Type	.20	.34	.54	.84	.27	.47	.16	.26

V-R Toolholders are also available for holding triangular, square and round inserts up to 1½" long. See Toolholder Catalog VR-435.

Write Today for New Toolholder Catalog and Price List VR-436

Vascoloy-Ramet CORPORATION

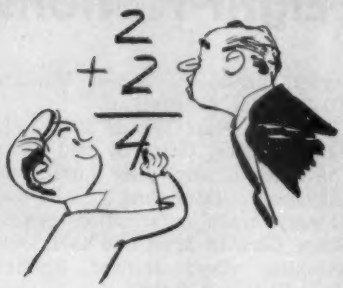
Since 1933—Makers of

THE WORLD'S FINEST CARBIDE

806 MARKET STREET, WAUKEGAN, ILLINOIS

*Patent Pending

Talking Shop . . .



Number Please

SUPERVISORY PERSONNEL at the Philadelphia plant of Minneapolis-Honeywell are going back to school on company time to brush up on handwriting. Weekly half-hour sessions for 12 weeks will deal primarily with number formation to avoid many of the elementary arithmetical mistakes that occur in plant records. For example, poor formation of numerals often makes 5, 3, and 8 hard to distinguish. The numerals 1 and 7 are also easily confused. Properly written, 1 and 7 are most easily recognized, and the others in decreasing order of legibility are 0, 4, 3, 2, 9, 6, 5, and 8.

The training program will also improve an employees' visual memory or awareness of the details characteristic to each numeral, thus speeding up recognition. This is expected to reduce office fatigue as well. Incidentally, women show greater ability with number recognition than do men in tests thus far.

Filing by Power

ONE COMPANY with considerable burr removing to do on aluminum castings has built its own machines. A "roof" with about 120° included angle is set over the file motor. A flat table top is hinged at the "roof" peak so it can be tilted. Thus the casting can be set on the table and moved at will against the file.

Across the Valley?

ABOUT FIVE YEARS AGO, in exploring the possibilities of high-speed machining, we ventured the opinion that there was evidence to show that heat and horsepower requirements might be less at very high speeds than at intermediate speeds. We've been in a lot of arguments about this and some experts have taken violent exception to it, despite which evidence accumulates.

In reporting on their evaluation for the Air Force of the Cincinnati high-speed milling machine, Convair engineers at Ft Worth report that efficiency of the cutter *went up* when operating above the rated horsepower. Face-milling 75ST aluminum at 10,700 rpm and a chip load of 0.0052 in. from 225-ipm feed, 50 hp is consumed, removing 3.38 cu in. per hpm. With a chip load of 0.0064 in. from 275 ipm, 77 hp is consumed (a 54% overload), removing 3.57 cu in. per hpm. Reports Convair: "A satisfactory conclusion has not yet been reached to account for the increased efficiency of the motor when using the additional horsepower."

Dollar Diary

AMERICAN AIR FILTER CO, Louisville, has translated each item of the company's 1953 operating statement into days of work, and has translated this into a giant calendar posted on all employee bulletin boards in three cities. Of last year's expenditures, 138 days went to pay wages, salaries and commisisons, 134 days to buy materials, 55 days to buy supplies and service, 23 days for taxes, 8 days for new equipment and plant, and 7 days for dividends. Copies have been made available to any of the 2,254 employees and agents and 2,169 stockholders who wish them.

Vertical Model

USUAL ARRANGEMENT for scale models of plant layouts is on a big table in the center of the planning room. When the model is more than about 6 ft wide, making changes in the central section can prove a bit awkward. A different approach was tried by the Ordnance Div of Food Machinery & Chemical Corp in retooling the San Jose plant for a different personnel carrier. Aluminum sheets were painted white, scribed in ¼-in. squares and mounted on the wall of the planning room. With building walls and columns painted in, layouts were made by attaching colored-paper cutouts with cellophane tape. Planners at Food Machinery like this arrangement better, they say, because it takes less space, is easier to see, and (with a small ladder) any portion can be reached for revision without having to walk on finished sections.

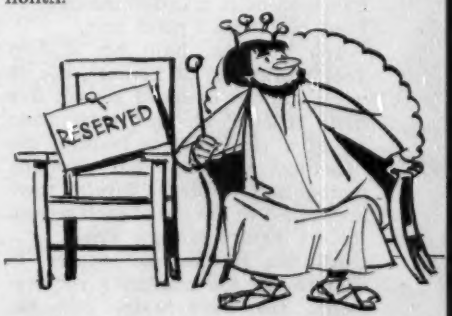
Steam Cabinet for Dies

PREHEATING FORGING DIES after they are mounted in the hammer can cause a lot of downtime if runs are short and die changes frequent. At Gardner-Denver's plant in Denver, 100 pieces is normally a large lot and a large inventory of dies is maintained. Just outside the steam-hammer building, and adjacent to die-storage areas, is a cabinet large enough to hold about ten sets of dies. Two sets of steam coils running just under the die racks and a third at the top of the cabinet keep the temperature at about 230 F. The cabinet is able to hold enough dies to allow some leeway in scheduling even after dies have been placed in the cabinet for preheating.

Last forging made in a run is always left with the dies. It settles all subsequent arguments as to whether the dies are still to size or not, provides an easy means to check need for rework before another run.

Iron Worker

SOME BIBLE READERS may recall that in 931 BC when King Solomon dedicated his Temple, the seat of honor at the right of the throne was occupied by an iron worker. C U Scott of Rock Island, Ill, claims the same seat 2885 years later in a current announcement. Mr Scott, an 84 year-old veteran of the Spanish-American War and president of C U Scott & Son, Inc, went to work at Rock Island Arsenal 51 years ago. Two years later he discovered a way to anneal HSS in 35 min instead of 18 hrs, and described it in an article in *AM*. He organized his company shortly thereafter and in 1928 worked on Super Scottsonizing, a secret process for hardening stainless steel. He claims to be able to apply an extremely hard surface 0.003 to 0.005 deep by a new process, holding size within a millionth.



CANADIAN TRADE FAIR: Eight Nations

British, German, Italian and other European nations vie with US and Canadian builders as machine tools take the spotlight at Canada's International Trade Fair

TORONTO — Billed as "the real giants of the Canadian International Trade Fair," and allotted a separate section for the first time this year, machine tool exhibits nevertheless weren't quite up to last year's spectacular standards. And most of the machines shown had a familiar look . . . they had been seen before at other fairs, even at the 1953 Canadian Fair.

One-fourth of the exhibit space during the Fair, held May 31-June 11, was taken up by machine tools, which practically filled the Industry building and overflowed into a second hall. But the overflow wasn't nearly as big as last year's.

Aside from the Canadian machine-tool builders and their distributors, Great Britain was the dominant factor in the machine-tool exhibits, with big displays by Alfred Herbert, Archdale and many others. Several top British machine-tool builders were in attendance, headed by R G D Ryder, president, British Machine Tool Trades Association.

Running close behind Britain in exhibit space, Germany had twice the space of any other continental European country. And it had a machinery trade information center. Some German firms had their own exhibits: others showed through their Canadian outlets.

Familiar German names among exhibitors included: Burkhardt & Weber, Collet & Engelhard, Friedrich Deckel, Gildemeister, Heyligenstadt, Schutte, Weisser, Pfauter, Werner, Naxos Union, Hahn & Kolb, Index Verkaufe, Lindner, Loewe, "Jerwag," Bohle, and Heller.

Contrasted with this, comparatively few US machine-tool builders exhibited. but they were major ones:

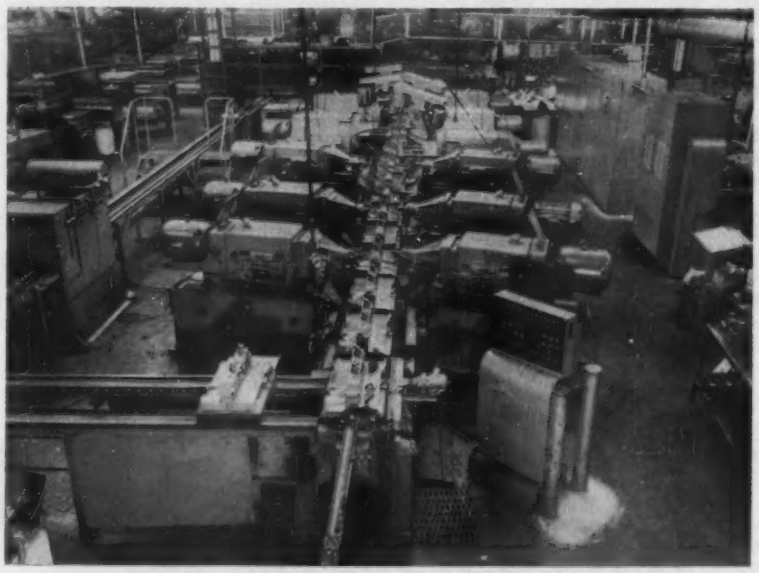
Made-In-Canada Transfer Unit Ups Ford Output

First Canadian-built transfer machine, installed at Ford Windsor, mass produces ball joints for front-end suspension of Mercurys and Monarchs

WINDSOR, ONT — Boring, facing, chamfering, rough and finish forming, drilling, spotfacing, reaming and tapping of upper and lower ball joints for front-end suspensions are all being accomplished with the first Canadian-built transfer machine at Ford of Canada's plant here.

The machine, built by Modern Tool Works Ltd of Toronto, has 15 work stations designed around five basic "island" sections, each made up of a rigid casting housing the indexing, locating and clamping mechanisms. Hardened dovetail ways are affixed to the top of each section for the fixture to slide along.

All five sections are spaced to conform to the machine's requirements, and ways bridge gaps between sections. All assemblies are identical, each carrying its own part of the transfer bar. Cam bar for actuating locating pins is treated the same way. With sections properly spaced and locked by the ways, the portions of transfer and cam bar are joined to form the machine's main structure.



FORD OF CANADA'S TRANSFER MACHINE has 15 stations designed around five basic sections, or "islands"

Each side of the island casting is completely machined so that work stations may be located at any position on these faces. If design changes are made on the components, more work stations can be added wherever there is an idle station. Complete section assemblies may be added or removed as needed.

In loading, return conveyor, set in motion by the previous cycle, moves a fixture toward the loading station, and when conveyor halts

Compete for Machine-Tool Business

Cincinnati Milling, Brown & Sharpe, Jones & Lamson, Landis Machine Co, Giddings & Lewis, National Automatic Tool, Dumore, National Acme, Sheffield, Lodge & Shipley, Thompson Grinder, South Bend Lathe, George Gorton, Walker-Turner, Sheldon, Delta and Potter & Johnston.

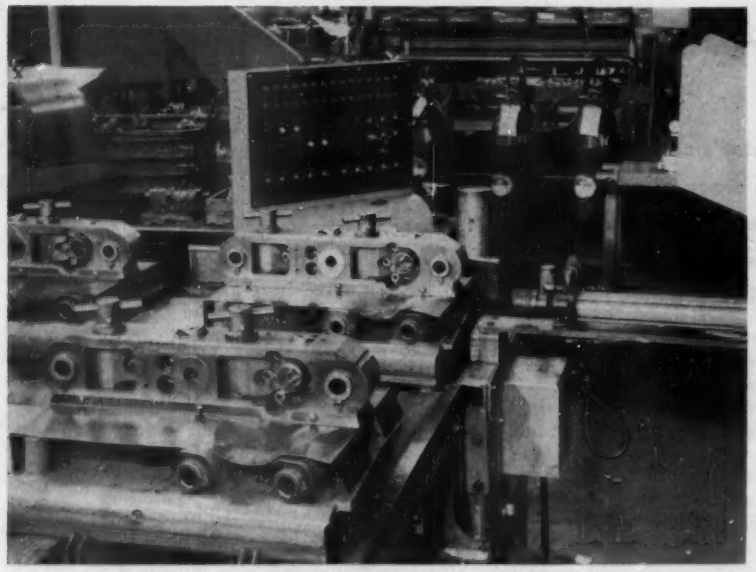
Some 26 Italian machine-tool firms exhibited, including Ceruti, Fiat, Minganti, Misal, Morando, Oerlikon Italiana, Olivetti and Maserati. Italian Machine Tool Builders' Association's new manager M Bruniera, was on hand, too.

Also represented were several Swedish and Belgian firms and 10 French machine-tool builders.

While Canada's machine-tool industry was well represented at its own Trade Fair, some builders shied away. Their reasons: the Fair is held too often (once a year); light buyers' attendance; and resentment of the Canadian government's encouragement of foreign machine tool sales to Canada.

Shown at the Fair for the first time on this continent:

- Olivetti (Italian) automatic hydraulic grinder, universal type with swivel wheelhead, infinite variation of revolutions of the work, workhead with live and dead centers, and internal grinding attachment. Single lever controls table traverse, work rotation, coolant flow, rapid wheelhead approach.
- Churchill-Redman (British) 12 x 40-in. hydraulic profiling lathe, now with multi-cut cycling control for fully automatic operation. Lathe takes up to four successive cuts while machine adjusts itself automatically. Automatic spindle and carriage-feed changes.
- Murad (British) high-speed, ram-type turret lathe with choice of 24 spindle speeds. All slides are hand-scarped to 0.005-in. alignment. Peak speed: 4800 rpm.
- Cri-Dan (French) Type E Sentinel semi-automatic, high-speed threading machine that incorporates the Cri-Dan process, making it possible to do other machining operations in the same chucking—turning, boring, chamfering, facing. In some cases these operations can be done along with threading.
- Demoor (Belgian) oil-field lathe that takes stock of 9-12½-in. dia through hole of the spindle. Unit incorporates hydraulic screw-cutting attachment with automatic-cycle operation to permit external and internal, parallel and taper screw cutting.



CANADIAN-BUILT TRANSFER MACHINE'S operating console and rear view of fixtures. Assist cylinder at right positions loaded fixtures

all workholding units are automatically indexed. At completion of transfer, locating pins enter the fixtures, which are hydraulically clamped. Units then advance, perform their operation, and return.

Transfer bar returns during work cycle, ready to pick up fixtures for the next index. When workholders are indexed, a station is left idle next to the loading station, and operator moves fixture into this space with an assist cylinder. He then presses the cycle-start button and conveyor delivers the next fixture onto the loading station.

Chips at the work station are channeled into a drag-type chip conveyor that deposits them at the far end of the machine. Tooling is completely exposed to simplify problem of changing cutters.

BROWN & SHARPE TO MODERNIZE SCREW MACHINE FACILITIES

PROVIDENCE, RI—Nearly $2 million will be spent by Brown & Sharpe Mfg Co of this city in modernizing its screw machine production facilities, it is announced by Henry D Sharpe, Jr, president. This, Mr Sharpe says, is for capital expenditures only, and does not include an estimated $3 million more for development costs to implement refurbishment of screw machine facilities.

Part of Long-Range Program

This is the first step in a long-range expansion program. Further major capital improvements will be carried out in the next few years, according to Mr Sharpe, despite current reduced business levels.

Bulk of the present appropriation will be for improvement of machinery in the existing screw machine manufacturing facility. Succeeding phases of the plan envision remodeling of the facility to afford better utilization of floor space, improve work flow, and cut manufacturing time.

MODERATORS of the Forum's technical sessions included (left) G Swardenski of Caterpillar Tractor Co and J H Mansfield of Greenlee Bros Inc. Vickers General Manager K R Herman welcomed the guests, introduced the moderators

SPEAKER Herbert L Tigges of Baker Bros Inc, president, NMTBA, opened the two-day hydraulics forum

Machine Tool Hydraulics

Do pressure gages add to an operator's confidence? Are separate power units for each stage of a transfer machine preferable to a single all-purpose unit? That's a random sampling of questions asked and answered at Vickers Inc's invitation Production Machine Tool Hydraulics Forum

DETROIT—At the invitation of Vickers Inc, Detroit hydraulic pump manufacturers, 125 top operating men, technicians and executives from a wide cross-section of metalworking firms met here May 11-12 at the Shelton Hotel to talk over mutual problems in application of hydraulics to production machine tools.

First of two sessions dealt with circuit and system problems, manifolds, pump and valve design, fluid motors and maintenance.

Typical of the problems covered, a discussion of the relative advantages of separate hydraulic power units for each station of a transfer machine, as opposed to an overall unit for actuating transfer bars and machine heads, brought out contrasting views from machine tool users and builders. Said the users: a single overall power unit creates pressure drops and surges that can result in reduced tool life, even in tool breakage. Said the builders: extra costs of separate units in terms of pumps and controls can be prohibitive.

In discussion of ways to cut down shock in hydraulic systems without affecting oil flow, a builder said that slight tapers on valve spools help reduce shock when a hydraulic machine is stopped suddenly. Smooth reversals can be aided by precision-machined needle-valve spools, he said.

Solenoid Valve Failure

Other session discussion covered solenoid failure in valves (the consensus: breakdowns are largely because of contamination caused by carelessness in leaving protective covers off during maintenance. One solution: mount the solenoid on the cover so the valve won't work if it isn't covered); best types of filtering equipment for machine-tool hydraulic systems; and whether machine-tool builders should supply a device to warn when a filter element requires attention.

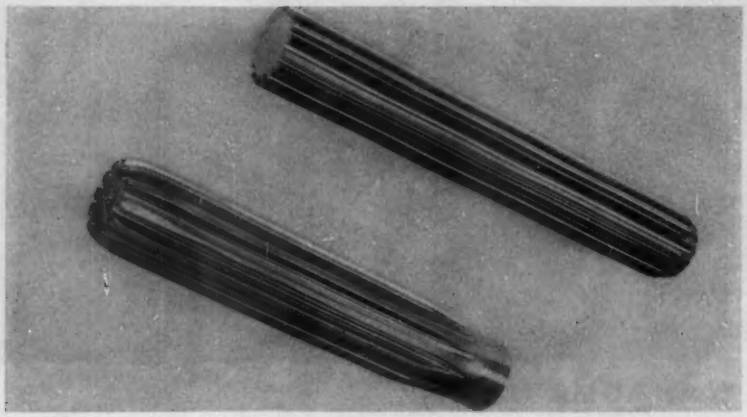
Second session began with petroleum fluids and fire-resistant fluids, then went on to cover fittings, tubing, hose and seals.

It was suggested that flange connections be used to replace pipe threads (where the group felt 90% of all leaks occur), and that tubing should be as rigid as possible (aircraft firms install blocks at intervals along the line to eliminate vibration).

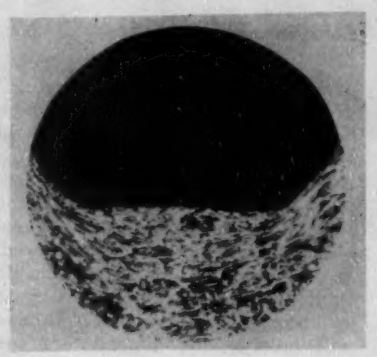
Hose Replaces Piping

Some users, it was revealed, have replaced piping with hose to reduce shock. Another uses plastic tubing, but only at pressure up to 150 psi. One man, in describing his firm's investigation of seals, mentioned a development that permitted 65 connections and disconnections without a leak during a six months' test: a thin, high nickel alloy ring that can seal at pressures up to 4300 psi.

Winding up the forum was a visit to Vickers Inc's plant, where the conferees were shown through the development laboratory, and through production operations.



PLASTIC FLOW OF METAL IS RADIAL, not longitudinal, in the Grob method of cold forming gear teeth, splines or grooves in OD of steel or bronze blank. Finished part is thus larger than the blank, as shown in these test pieces



Nitel etch x20

ROOT OF SPLINE GROOVE in SAE 1038 axle shaft shows good grain structure, without tears

Cold-Forming Gears and Splines

Grob Corp's new high-speed automatic machine cold-rolls external gears and splines at double the output rate of two eight-spindle rotary gear hobbers in tests at a major Detroit automotive plant

GRAFTON, WIS — A new process that cold-rolls external gear teeth and splines on steel blanks with a high-speed automatic machine has proven its worth in extensive tests at a major Detroit auto firm, where, according to its inventor, Benjamin Grob, president of Ben Grob Corp of this city, the machine has outproduced two eight-spindle rotary gear hobbers in forming splines on the ends of rear axle shafts.

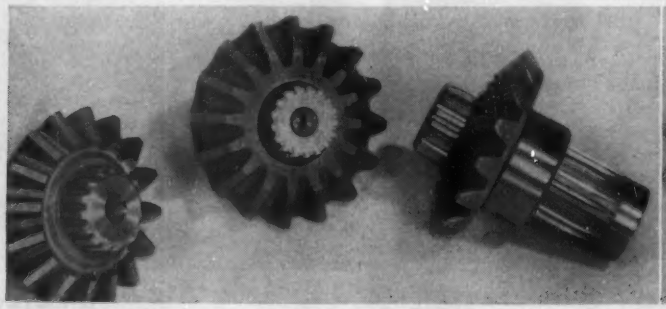
The process, which can cold form some bronzes, as well as gear and tool steels, involves principles never before employed in cold forming, and which cannot be divulged at this time.

As demonstrated to *American Machinist*, the rolling cycle involves high-speed operation of easily adjusted rollers, and comparatively rapid feed of the workpieces. Result: faster production.

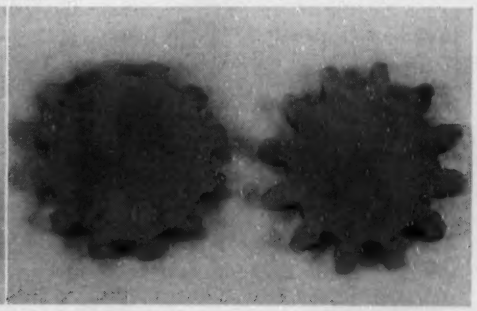
Gears and splines of straight or helical lead are rolled in one pass of the workpiece through the rollers. Gear teeth, splines and other straight or helical grooves are easily formed with straight-side, involute, or almost any desired intermediate form.

Centerless Rolling

The process involves a centerless rolling operation, with accuracy of the blank periphery determining accuracy of the finished part. The ratio of variation between blank diameter and OD of finished part depends upon the ratio of blank circumference to the sum of the widths of the tops



FIRST COMMERCIAL APPLICATION OF GROB PROCESS is production of splines on ends of auto rear axle shafts. Test splines shown fit mating gears smoothly, and no rolled-spline shaft has yet broken in tests



CUT-OUT SECTIONS from rolled splines and gears show accurate development of required form, improvement in grain structure, and smooth, hard rolled surfaces. Gears have been rolled successfully with teeth as large as 6-DP

Cold Forming (cont'd)

of the teeth or splines. "Top rolling" generally is not desirable, but can be done if the blank diameter is held with extreme accuracy.

Variations in blank diameter affect only the growth of the top of the teeth, they do not affect the shape or accuracy of tooth profile produced. In other words, within reasonable limits excessive material in the blank will flow to the tops of the teeth, and will enlarge the diameter of the finished part without affecting the shape of the teeth formed by the process. If the OD of the finished part must be held to close limits, as when producing oil pump gears, it usually is desirable to grind the OD after rolling. For example, the square spline section shown has been ground after rolling, while the 45° bevel along the side of each tool was produced by the rolling operation. For most practical purposes, top finishing is not needed.

Radial Plastic Flow

Plastic flow of the metal is radial, not longitudinal. Very little power is required (a 3-hp motor drives the rolls, the feed mechanism and the lubrication pump in the test machine now in operation), and no heat is generated during rolling. A lubricating oil is flowed over the workpiece during the rolling operation.

For this rolling process, it is essential that the blank not be cold worked prior to rolling, or that it be annealed before rolling if previously cold worked.

Progressive Forming

The gear teeth or splines are formed progressively by this new process, which depends on increased pressure in all affected parts of the blank. When the blank is first engaged by the rollers, it is essential to make deep penetration immediately. At no time is any portion of the blank subjected to tension, so there is no tendency to tear or fracture the metal. It is Mr. Grob's belief that this is the essential reason why grain structure produced by the process is dense and strong.

Design Not Yet Complete

While a test machine now is in operation in the field, design of the rolling machines to be used in this process has not been completed. It is expected that several different types will be developed soon.

New AGMA Officers

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Richard B Holmes
General Manager
Link-Belt Co
Philadelphia

VICE PRESIDENT
Marvin R Anderson
Executive Vice President
Michigan Tool Co
Detroit

Gear Men Meet at

Top attendance marked the 38th meeting of AGMA, when gear specialists turned the searchlight inward on themselves and their industry. Their object: better, stronger gears at a lower cost

HOT SPRINGS, VA:—A new high in attendance, more than 354, was attained at the 38th Annual Meeting of the American Gear Manufacturers Association here June 6, 7, 8, and 9. The meeting also differed from recent annual meetings in that several technical papers, rather than one, were presented, and all proved to contain outstanding new information.

The first general meeting on Monday included a symposium conducted by the Gear Rating Coordinating Committee on "Fatigue Strength Characteristics of Gear Teeth," in which three members of the committee, E J Wellauer, Falk Corp; D W Dudley, General Electric Co; and Wells Coleman, Gleason Works; collaborated.

The second paper was presented on the following morning. "A New Look at Wormgear Hobbing" by Ernest Wildhaber, is reproduced in an 8-page Special Report in this issue. Discussions of this paper showed that its suggestions have already been tested in several plants. Granger Davenport, of Gould & Eberhardt, pictured and described a case study indicating that the theoretical data of the report can be used in production with some adjustment. D W Dudley, of General Electric, who is currently making tests, reported that the information looks good and can be used with relatively slight adjustment. He felt it particularly valuable to the industry that a man of Mr Wildhaber's caliber had put his mind to the problem. Mr Davenport's

Elected

John A Sizer
President
Industrial Gear Mfg Co
Chicago

TREASURER
Fred R Eberhardt
President
Eberhardt-Denver Co
Denver

Hot Springs

results will be shown in more detail in a later issue.

The third paper, "The Span System of Measuring Involute Gear Teeth" by J E Van Acker of Gould & Eberhardt, Inc, was based on a method published by Mr Wildhaber in 1923. This is an expansion and modernization, providing a gear-measuring system for a job-lot use on all spur and helical involute gears. It permits gears to be measured while still in the machine, even while a machine is still running. Accuracy of measurement is not affected by outside diameter errors, including runout, and no particular skill is required. The system is based on the geometrical fact that any normal to any involute tooth surface will be contained in a plane tangent to the base cylinder. Thus two parallel caliper jaws will tangentially contact oppositely facing tooth profiles in a manner similar to diameter measurement of a cylinder, and with a similar feel. Mr Van Acker provided in an appendix detailed involute and geometrical functions as well as span dimensions for common pressure angles.

As is customary, a great amount of work was done on standards by the various committees. The work resulted in approval of several additional standards and modernization of existing ones, plus submission of several to the ASA for adoption for American standards. These will be reported in *AM* when processing is complete.

At the annual banquet Tuesday evening, Admiral Paul F Lee (USN Ret), vice president of Gibbs & Cox, Inc, was awarded the Edward P Connell Award. This is the first time the award has been made to someone not immediately involved in the gear industry. Admiral Lee was, however, concerned with gearing for naval vessels during World War II and was a major factor in the excellent record made during that period.

Propulsion power in American naval vessels rose from 12 million to 100 million hp in about three years, and major gearing advances were made at the same time despite the obvious emergency production conditions.

Banquet attendance was just over 300 persons.

FOA GUARANTEES CONE AUTOMATIC AGAINST EXCHANGE LOSS

WASHINGTON — Cone Automatic Machine Co, Windsor, Vt, manufacturer of multi-spindle automatic screw machines, has received a Foreign Operations Administration guaranty against loss over the next 10 years for its new subsidiary in Birmingham, England, if that firm is unable to transfer its receipts for sale of automatic lathes in the sterling area into dollars.

Spurs Overseas Investment

Cone's guaranty is in line with FOA's Investment Guaranty Program to spur US investment in free world nations. The firm's $150,000 investment has been converted in sterling, creating a sterling-area source of automatic lathes, which otherwise would have to be imported from the US. This means a substantial British saving in dollar exchange.

Cone estimates that when its British subsidiary reaches full production, about 75% of current US lathe exports to Britain will be replaced by locally produced automatic machines.

CLARENCE HAMILTON DIES

DAYTON, OHIO—Clarence Hamilton, executive assistant to the president of the Sheffield Corporation of this city, died on June 7, following a heart attack that occurred while he was on a recent business trip in Canada.

to AGMA's Executive Committee

LeRoy R Brooks
President
Tool Steel Gear & Pinion Co
Cincinnati

T F Scannell
General Sales Manager
The Falk Corp
Milwaukee

Ralph E Rawling
President
Rawling Gear Works
Worcester, Mass

JAPAN'S OSAKA TRADE FAIR drew upwards of 270,000 to view hundreds of industrial and commercial exhibits

JAPAN: Industry on the Rebound

Obsolescence, lack of raw materials and inflation are the biggest roadblocks in Japan's march toward industrial recovery. But the Japanese are getting around them by using US production techniques to make the most of what they have. And they're very much in the market for US and foreign machine tools that will help them do the job

NEW YORK — "Almost 100% equipped with obsolete, worn-out machine tools," is the way Japanese metalworking plants are described by Donald M Laflin, vice president sales, Giddings & Lewis Machine Tool Co, Fond du Lac, Wis, who has just returned from a two months' tour of Japanese industry.

But the Japanese are fully aware of the obsolescence of their metalworking equipment, and they want to do something about it in spite of an inflationary economy and post-World War II, US-imposed restrictions that limit operations of its prewar trusts. As a result, Japanese economy and industry are today going through an upheaval which Mr Laflin believes is the final stage before Japan reaches something like its prewar status.

To accomplish its march back to industrial recovery, Japan badly needs modern machine tools and production techniques. Some machine tools are built in Japan, but made-in-Japan machine tools failed to dominate Japan's own trade fair at Osaka April 10-23. Most popular machine tools were those from Switzerland, Germany and the US.

In all, foreign exhibitors sold $861,000 worth of machine tools at the Osaka Trade Fair—with Germany making 54 sales valued at $360,000, Switzerland 29 sales for $230,000, the United States 24 sales for $208,000, and England 12 sales at $95,000. Denmark sold only one machine tool, for $21,200.

Perhaps the most progressive firms in Japan, Mr Laflin says, are the automobile manufacturers. Mitsubishi Nippon (Henry J's) employs large numbers of US tools, and Nissan automobile (Datsun cars, Nissan buses, and trucks) is "reasonably well equipped" with American tools of prewar design, mostly standard types. Nissan is also slated to build English Austins, and the firm will probably have the backing of the Japanese government in getting new machine tools.

One of the best-equipped plants in Japan, according to Mr Laflin, is Isuzu Motors at Tsurumi (truck and bus diesels, gasoline engines). This firm has just been licensed to build the Hillman Minx. Large numbers of US machine tools are in operation, but even here the plan is badly in need of some basic metalworking equipment items.

Aircraft Industry Reviving

Shin Mitsubishi's plant at Oye, Nagoya, was Japan's biggest aircraft plant before and during WWII, but today is devoted mostly to building automobile bodies and frames. However, Mitsubishi is concluding or has concluded a contract to build North American Sabre Jets and will need new tooling for aircraft production. Shin Mitsubishi is tied in with several other offshoots of the old Mitsubishi combine, making many types of metalworking equipment and products, from machine tools to household appliances, and is licensed to manufacture US jeeps.

One other firm is prominent in the jet aircraft field—Nippon Jet Engine of Tokyo—another offshoot of Mitsubishi. Nippon Jet is said to have a jet engine design of its own, but it's mostly on paper and tooling details haven't been worked out as yet.

In the general machinery field, Mr Laflin found that lack of operating capital is hindering expansion and equipment is generally in an advanced stage of obsolescence. Lone exception to the general obsolescence throughout this industry is Kubota's plant near Osaka, where an efficient conveyorized line turns out 10,000 pump diesels a month.

Japanese shipyards, with one or two prominent exceptions, are in disfavor with the government because of widespread scandals that could have lasting repercussions because shipbuilding is government subsidized. In some shipyards, equipment is so bad that most finishing assembly is done by hand—a costly process even at low Japanese labor rates. Some shops, however, are fairly well equipped. And Shin Mitsubishi's A-bomb-damaged yard at Hiroshima is making the best of an inflationary situation by rebuilding and modernizing its machine tools.

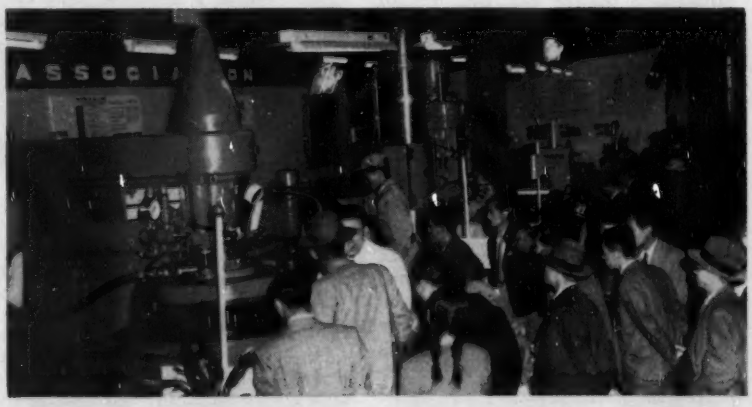
Machine Tool Activity Low

Activity in machine tool plants seemed to Mr Laflin to be fairly low throughout Japan. One of the largest plants, Okuma Machine Tool Co at Nagoya, is devoting most of its output to textile machinery. Okuma also makes medium-sized engine lathes, radial drills, and copies of foreign universal radials. Toyo Koki, Toyo Motors' machine tool plant, is currently building way-type drilling machines, rotary and drum-type milling machines, special machine tools, and does jig and fixture work for Toyo Motors. Hitachi Ltd's machine tool plant, Hitachi Seiki, near Tokyo, is building milling machines, special machine tools, and a turret lathe with preselective head. This shop, according to Mr Laflin, is one of the better machine tool plants. Osaka Kiko makes almost all types of machine tools, but here as in most machine tool plants, activity was low.

In all, Mr Laflin saw "very few new tools" during his extensive tour of Japanese metalworking installations. But, he says, when and if ready capital becomes available to the Japanese, it will take manufacturers at least 10 years of intensive buying to replace their obsolete equipment.

MADE IN JAPAN, diesel engines and three-wheel trucks manufactured by Daihatsu Industrial Co Ltd attracted buyers from all over the Orient

METALWORKING TOOLS AND PRODUCTS shown here include machine tools from Japan and Germany, diesel engines from Japan



DISPLAY OF JAPANESE MACHINE TOOLS, by Taugami Mfg Works was a principal attraction at the recent Osaka Trade Fair

OFFSHORE PROCUREMENT:

US Purse Strings Are Tightening

Lush offshore procurement contracts, designed to keep Western Europe's arms plants operating and intact until such time as their own economy could support them, are getting fewer and farther between. One reason: growing opposition from US industry in a period of business slack-off

WASHINGTON — US spending abroad for military hard goods — planes, ships, tanks, shells, electronic gear—is about to taper off. During the next 12 months, expenditures for such items with European companies will run around $300 million, compared with $800 million this year. But at the same time, purchases in the US for arms to be shipped to allies overseas are tapering off, too. (See table).

US ARMS PURCHASES FOR ALLIES
(millions of dollars)

Fiscal Year	Bought in the US	Bought Offshore
1952	$4147	$629
1953	1628	1500
1954 (est)	1060	800
1955 (est)	600	300

Purchases End in '57

Under present schedules, all such purchases will be ended by the end of fiscal 1957. This means that from here on out the US will be mostly closing out existing contracts. By the time it's all over, expenditures under the program will have totaled around $4.5 billion. About $3 billion has been spent to date under the program.

Political Opposition

Offshore procurement generated some political opposition in the US. Main objection has been that the government is placing contracts abroad instead of spending the same amount of money at home to the benefit of domestic industry and domestic labor at a time when the business picture is a bit dim.

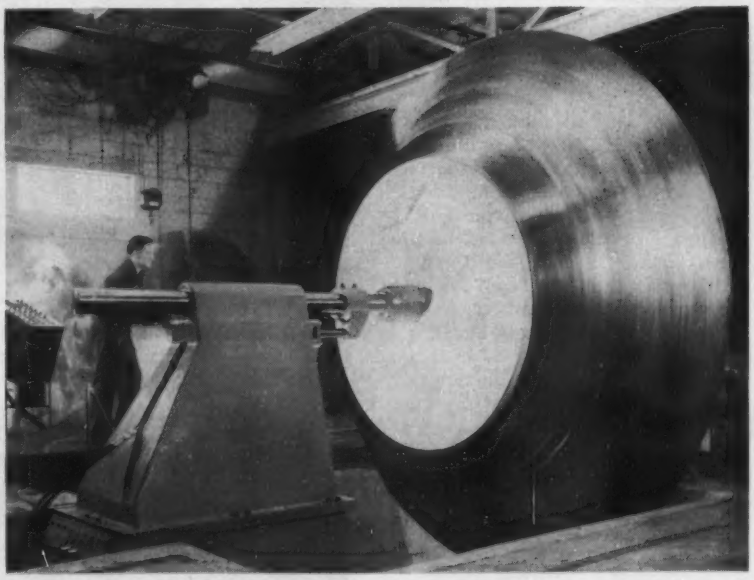
Bolsters Europe's Economy

Overall purpose of the offshore procurement plan, in addition, of course to supplying US allies with arms, has been to keep European arms plants ready and running until their own economies could maintain them. Only existing facilities have been given orders: no new plants have been built. Here's how the offshore procurement money was spent in 1953: ammunition and explosives $673.9 million; aircraft and equipment $410 million; ships and equipment $106.6 million; vehicles other than transport $82.5 million; and electronic equipment $71 million.

During 1953, the Army placed 141 offshore procurement contracts for a total of $912.4 million, broken down this way: $625.7 million for ammunition; $82 million for Centurion tanks, gasoline trailers and spare parts; and $44 million for electronic equipment.

Navy awarded 77 contracts totaling $211 million, including: $106 million for ships and equipment; $47 million for ammunition; and about $13 million for aircraft.

Air Force awarded a total of 145 contracts amounting to $472.6 million for planes and related equipment, and $17 million more for radar and electronic equipment.



Biggest?

180-IN. DIA SWING METAL SPINNING LATHE, recently installed at Phoenix Products Co's Phoenixspun Division, Milwaukee, is said to be the world's largest. Designed to meet the need for larger spun shapes in atomic energy plants and for industrial air conditioning equipment (workpiece shown is a 14-ft air conditioning unit dome), the lathe can spin stainless steel, chrome-moly steels, cupronickel alloys and titanium alloys. Portable panel controls all operations. Spinning tools are hydraulically actuated, and hot-spinning pressures can be built up to a never-before-reached point. Machine will spin ⅝-in. steel, ¾-in. aluminum to 72-in. depth

Vas Peickii

William D Reed

Stanley W Lovejoy

Names in the News . . .

Vas Peickii has been appointed factory manager of Micromatic Hone Corp's Los Angeles plant. Mr Peickii is a former partner of the M E Engineering Co of Los Angeles, recently acquired by Micromatic. Before heading his own company in 1946 Mr Peickii was development engineer for the Crane Co, and tool engineering manager for Lockheed Aircraft.

Bennett Archambault has been elected president and a director of Stewart-Warner Corp. He succeeds **James S Knowlson,** chairman of the board since 1934, and president since 1939. Mr Archambault has been associated with the M W Kellogg Co of New York as vice president and general manager.

J H Humberstone, president of the Ohio Chemical & Surgical Equipment division of Airco in Madison, Wis, has been named president of Air Reduction Sales Co. Mr Humberstone, who is also vice president of Air Reduction Co, succeeds **H R Salisbury,** who retired June 1.

William D Reed, former superintendent of fabrication at the Convair Div, General Dynamics Corp, San Diego, Calif, has been appointed works manager of H & B American Machine Co's Midwest Div. Mr Reed, who will make his headquarters in Indianapolis, was general foreman of Convair's experimental factory, and has headed the fabrication department for the past three years.

John W Schneider has been appointed manager of the Dearborn Iron Foundry and **Harold C Grant,** manager of the Dearborn Specialty Foundry of Ford Motor Co's Engine & Foundry Div. Mr Schneider has been manager of the Specialty Foundry since it was organized in 1950, and Mr Grant, production manager.

William Blackie has been elected executive vice president of Caterpillar Tractor Co. A vice president since 1944, Mr Blackie will continue to give administrative direction to the company's plants and subsidiaries.

Stanley W Lovejoy has been appointed manager, cutting tool research, for Pratt & Whitney, Division Niles-Bement-Pond Co. His duties will include basic research, development, and testing of products manufactured in the division. Mr Lovejoy has been associated with General Electric as tool supervisor of the West Lynn Works, and a consultant on cutting tool design and application.

Wilder Moffatt, design engineer at Bonney Forge & Tool Works, Allentown, Pa, for the past eight years, has been named projects engineer. His duties will encompass coordination of a program involving manufacturing and quality control, research and development, and analysis of machinery and equipment.

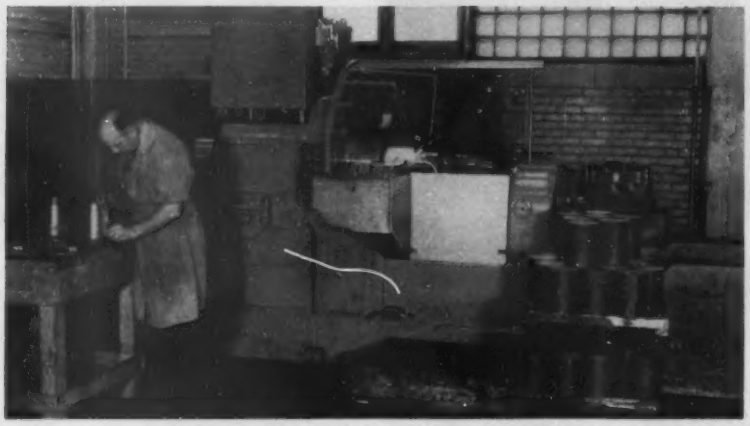
Frederick Dewey Van Norman, chairman of the board of Van Norman Co, Springfield, Mass, and one of the company's founders nearly 70 years ago, has been awarded the William Pynchon Medal, given annually to an outstanding resident of the community by the Advertising Club of Springfield. Mr Van Norman, who will be 92 in December, is the oldest active industrialist in the community.

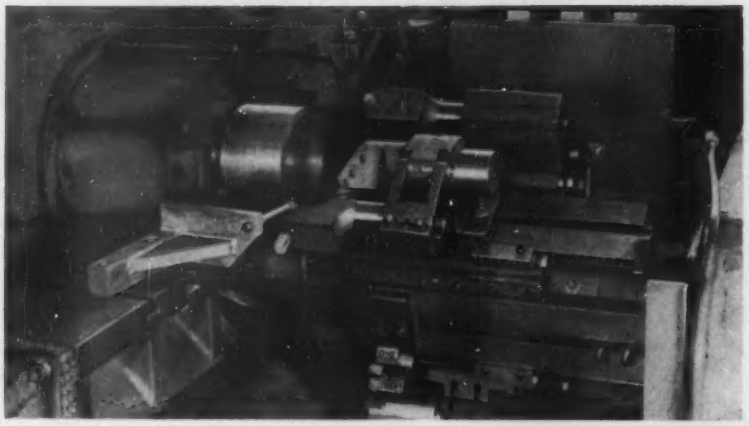
J H Humberstone

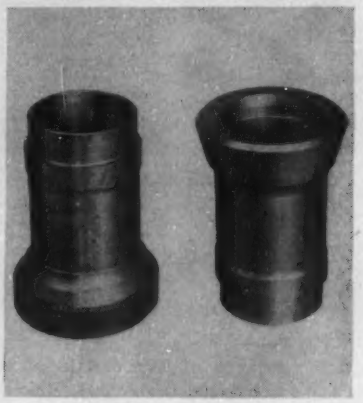
William Blackie

Frederick D Van Norman

New Shop Equipment,







AUTOMATIC CHUCKER PERFORMS 14 operations in setup for machining collet blanks while semi-finished blank is checked. Nine cuts are made in second setup to complete other end of workpiece (closeup of tooling area). Floor-to-floor time for first setup is 24.3 min, 11.1 min for second, compared with 56.0 and 42.0 min respectively by former method

Single-Spindle

Through completely automatic control of the entire machining cycle, National Acme's new Acme-Gridley chucker brings turret lathe work into the scheme of automation. Its open tooling zone and accessible chucking area provide plenty of room for automatic loading equipment so that the machine can be adapted to an automation line. A rotary-type chip conveyor is also available to facilitate applications of the machine in automated lines.

This 12-in. Universal single-spindle chucking automatic is reported to be as much as five times faster, floor-to-floor time, than other equipment of this class because of its predetermined cycle time.

Wide speed and feed ranges with speed changes automatically controlled permit combining carbide and high-speed tooling as well as threading in the same automatic setup. Each of five turret toolslides and two cross slides is independently cammed. "Idle time" movements such as advancing toolslides to cutting position, returning them after completion of cut to turret indexing position, and indexing of the turret slides, are all accelerated.

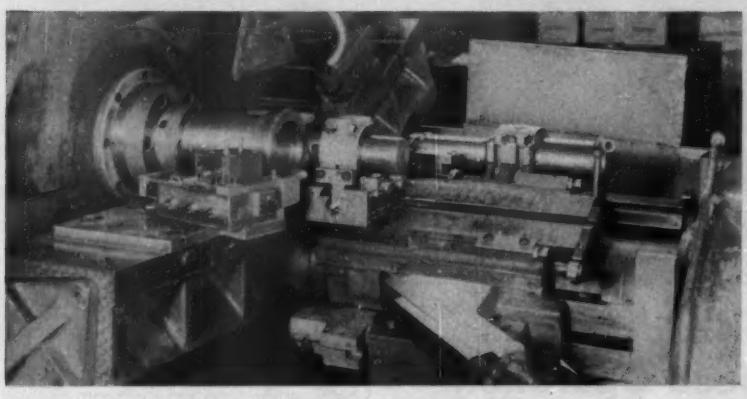
The tooling zone in the 12-in. Universal model MC is without interference from shafts or accessories. Cams are readily accessible, and the timing control switches are grouped for operation from cam dogs mounted on single drum at machine rear.

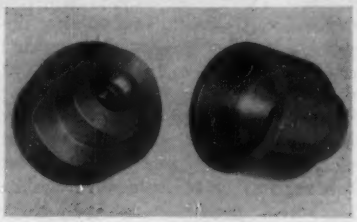
Adaptability for additional tooling, including specialized attachments for self-opening threading dies and collapsible taps, permits more operations to be included in a single automatic setup, thus avoiding rehandling the piece.

A husky basic frame structure, heavy toolslides without overhang, fast and shockless turret indexing, and modern safety devices which protect both machine and operator are typical of the National Acme line. A representative job performed on this machine consists of producing hydraulic cylinder bodies used in Acme-Gridley multiple-spindle chucking automatics. First-operation work on the large end of these steel castings includes ten machining cuts which are performed in floor-to-floor time of 10.7 minutes. Previous methods required 23.3 minutes.

Second-operation work on the other end of piece required 14 cuts (including a four-step reamer for finishing four diameters in the small

Materials and Parts . . .





FLOOR-TO-FLOOR TIME for machining hydraulic cylinder bodies in Model MC automatic chucker is 10.7 mins for 10 cuts in first setup, 8.9 mins for second which requires 14 cuts including step-reaming 4 diameters. Former method required 23.3 minutes for first, 30 minutes for second. Material is steel casting, 7¾ in. in diameter

Chucker Adapts to Automation

hole in the end). Model MC floor-to-floor time is 8.9 minutes compared with 30 minutes by former method.

Several collet blank jobs have been run on the 12-in. Universal. These are solid and master collet blanks for use on Acme-Gridley multiple- and single-spindle bar automatics.

First operation setups on these are particularly tough jobs involving heavy drilling, because a solid slug of 4150 special collet steel is used. Tooling included both carbides and HSS. Various operations were incorporated into an automatic machining cycle and automatic speed changes provided. Floor-to-floor time for the new chucker averaged nearly three times as fast as that of the methods previously used.

The National Acme Co, 170 E 131st St, Cleveland 8, Ohio

General Specifications

Nominal OD of Chuck	12-in.
Maximum Swing	13-in.
Slide Travel (Maximum Standard):	
Front and Rear Cross Slides	4½-in.
Maximum Length Turn and Bore	8-in.
Motor Horsepower (1800 rpm)	25 hp
Speed of Drive Pulley	695 rpm
Range of Spindle Speeds (Standard):	
Six predetermined speeds automatically obtained with each set of spindle speed change gears—6 automatically selected speeds in each of 17 speed ranges:	25 to 360 rpm
Lowest automatic range (6 speeds)	25 to 360 rpm
Highest automatic range (6 speeds)	102 to 148 rpm
Range of Feeds (Standard):	
Each toolslide (5 on turret and 2 cross slides) is independently cammed. Two automatically selective feed ranges are obtainable with each set of feed change gears—high range provides feed 4 times heavier than low range feeds shown:	
Turret Slides (low range—standard)	.0037 to .0448 ipr
Cross Slides (low range—standard)	.0007 to .0084 ipr

. . . including

Centerless grinder adapts to automation, produces parts by infeed or through-feed method page 178

Tracer-control lathe incorporates interchangeable boring and turning rests.....page 179

Two-way straightening press has two pressure units, each with longitudinal and transverse movement .....page 179

Splines are rolled-formed on machine with complete cycle time of less than ten seconds page 180

Hydraulic sharpening machine now accommodates wet-grinding of HSS and carbide-tipped hobs and form-relieved cutters page 182

Cold-treating chambers use special rotary compressors to produce temperatures to –170 F page 188

Gear deburring machine chamfers both sides of tooth and the root at one time at five teeth per second .....page 190

Automatic welding machines made in both disk and point types .....page 194

. . . and in July 5

Angular machine grinds thrust surfaces and adjacent diameters simultaneously in single, automatically controlled plunge grind.

Process forms parts from aluminum sheets and forgings by immersion in chemical solutions.

Landis Centerless Grinder Allows Through-Feed or Infeed Operation

Centerless grinder, designated Model 12½, is a heavy-duty machine which grinds parts to close tolerances on a high production basis. It incorporates features that make the application of automation both practical and economical. Automatic loaders and automatic cycles can be used for producion of parts by either the infeed or through-feed method. A variation of the infeed method, known as end-feed grinding, is used when grinding tapered work.

The unit will grind workpieces with a maximum diameter of 6 in.; maximum grinding wheel width is 10 in. Capacity of through-feed or infeed work rests is ½ to 3½ in. (standard), 3 to 6 in. (heavy duty). Grinding wheel diameter and hole is 24x12 in.; regulating wheel diameter and hole, 14x5 in.

Pressure lubrication is provided for the grinding wheel spindle bearings. This method floods the bearings with filtered lubricating oil from separate reservoir, has its own pump and safety pressure switch. Pressure must be built up in the circuit before the wheel drive motor will start. If pressure should fail, drive motor will stop.

Microsphere bearings are used for both grinding wheel spindle and regulating wheel spindle. These bearings are one-piece steel units, babbitt-lined. They operate at close clearance which results in close dimensional control and quick, positive sparkout.

Two methods of dressing the regulating wheel are available. One dresses the wheel on the line of work contact by hydraulically moving the wheelhead past a diamond mounted on the work rest. For an overhead dresser, Landis provides a dresser for hand operation and compensation for wheel tilt. A hydraulically operated profile dresser is also available for the regulating wheelhead. Regulating wheel speed is variable, by rheostat control, from 12 to 100 rpm. Regulating wheel dressing speed is 300 rpm.

The grinding wheel is at the right-hand side of the machine; the regulating wheel is on the left-hand side of the bed. Between the two is the work rest, mounted directly to the bed casting. Both wheelheads slide on ways with work rest positioned rigidly between wheels. The regulating wheelhead may be tilted for through-feed grinding operations and swiveled for taper grinding.

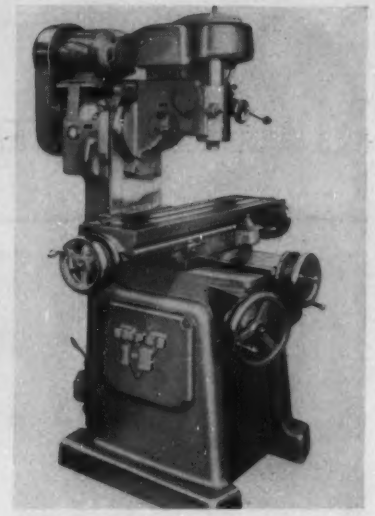
A variety of extra equipment and tooling is available. This includes hydraulic grinding feed, automatic cycles, hand and automatic work loaders, automatic dressing with automatic diamond feed, heavy-duty work rests, and sizing gages.

Landis Tool Co, Waynesboro, Pa

Fire Extinguisher

A 2-qt-capacity stored-air-pressure vaporizing-liquid fire extinguisher is equipped with a combination carrying handle and squeeze-type operating valve. The 30-ft hose stream is effective on Class C (electrical) and Class B (flammable liquid) fires.

Pyrene Mfg Co, 560 Belmont Ave, Newark 8, NJ



Vertical Mill Uses Counterbalanced Ram

Impco vertical mill Model 1-B for both production and toolroom milling incorporates head which is vertically adjusted by counterbalanced ram.

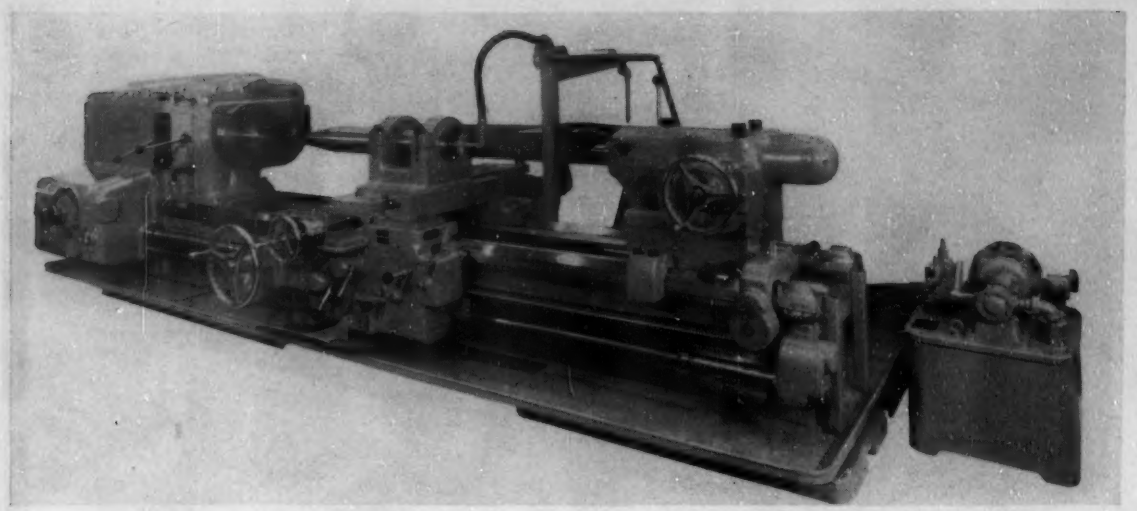
Ram design is reported to give greater accuracy and rigidity because of greater scraped bearing surface area. Table and centralized controls always remain the same height from the floor.

Model 1-B weighs 3100 lb, and table working surface is 10x40 in. Maximum longitudinal table movement is 24 in., cross movement 12 in. Range of opening from table to spindle nose is 4⅛ in. minimum, to 18¼ in. maximum. Spindle quill diameter is 3½ in., with 5-in. travel. Speed range is 75 to 3000 rpm.

Other design features include heat-treated alloy-steel gears, precision spindle bearings, large graduated dials, and one-shot lubrication system. Optional equipment includes large 10x48-in. table, longitudinal power feed for the table, vernier, and a cooling system.

Industrial Metal Products Corp, 3400 W St Joseph St, Lansing, Mich

MAGNETIC RETRIEVING TOOL uses Alnico V magnet attached to adjustable telescopic handle. All-angle ball joints permit instant adjustment as required, with spring-tempered steel links to hold pick-up angle. Available in three compact sizes—26 and 14 in., telescopic, and 8½ in.—*Ullman Products Corp, 15 River St, Norwalk, Conn*



Tracer Control Lathe Does Contour Boring and Turning

Combination lathe was designed for boring and turning work having irregular contours as deep as 8 in. on a side. Basis is the 25-in., 50-hp Pacemaker equipped with hydraulically actuated cross-slide which follows contour of flat work templet.

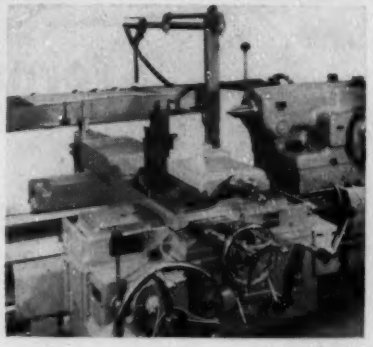
Interchangeable boring and turning rests are furnished to allow rapid changeover from boring to turning, and vice versa. Boring rest, illustrated above, forms a substantial mounting for the 6-in.-dia boring bar and is provided with an auxiliary bearing support across the right-hand carriage wings for maximum rigidity. Adequate cooling is assured by a setup which permits cutting coolant to be introduced through the center of the boring bar.

The illustration on the right shows the machine arranged for contour turning operations.

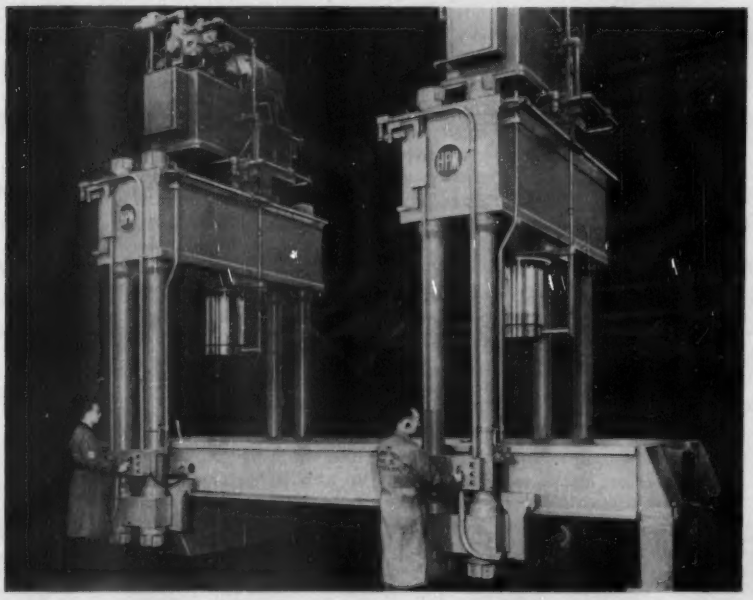
This view shows the flat work templet in position with contacting stylus, which actuates the tracer valves, controlling the admission of the 300-psi-pressure hydraulic fluid into the cylinder. Pressure reacts against the piston and controls movement of the cross-slide which carries the tool rest.

This combination contour boring and turning lathe is reported by the manufacturer to be particularly adapted to machining the intricate work contours encountered in jet engine production.

The American Tool Works Co, Pearl St at Eggleston Ave, Cincinnati 2, Ohio



Contour turning operations can be performed when the boring rest has been replaced by a compound rest with heavy-duty double screw toolholder



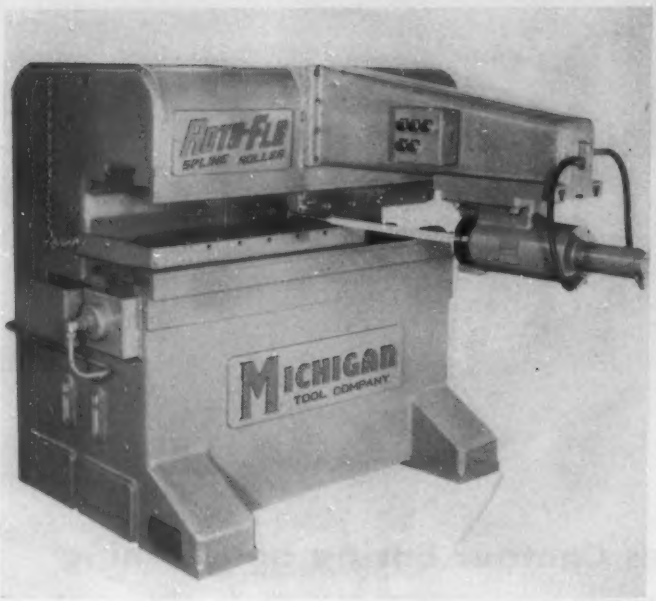
Two-Way Straightening Press Has Two Pressure Units

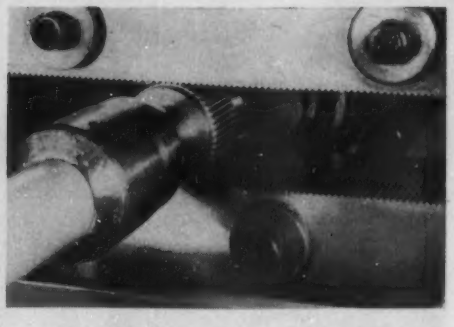
Two-way straightening press with two pressure units is reported by HPM to be the first of its type. It was designed to straighten parts, such as forgings, castings, extrusions, and weldments, where it is necessary to hold down one point while applying pressure to another, or to apply pressure at two points simultaneously.

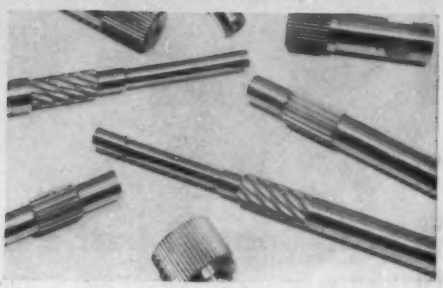
Spot pressures can be applied over practically the entire press bed area because the two units have longitudinal and transverse movement.

Each unit has capacity of 400 tons, and bed is 264 in. long and 96 in. wide. From each ram nose (with the ram raised) to the bed is 60 in., and each ram has a 24-in. stroke.

The Hydraulic Press Mfg Co, Mount Gilead, Ohio







Roll Forms Splines and Serrations

Splines, oil grooves, serrations, and other similar shapes on external parts are made by means of a cold-working process on machines to be known as Roto-Flo spline rollers, and made in three sizes. Shafts range in OD from ⅞ to 1⅝ in. Lengths of splines run up to 1¾ in.

In operation, a metal shaft is placed between two forming racks and after being rolled along the length of the racks in a single pass, emerges in a few seconds with the teeth completely formed at any desired position on the shaft. Because the metal is displaced and not removed, parts are usually made to the pitch dia before forming rather than the major dia and then turned down back of the teeth. This not only saves time and material, but tests indicate that parts with rolled splines will withstand higher torsion loads than parts of the same material on which splines have been hobbed or shaped.

For example, 90,000 in.-lb torque has been measured in one case as compared with 30,000 in.-lb by hobbing the same part. This increased load capacity will permit designers to employ finer splines for jobs that now require relatively coarse teeth. Photomicrographs of polished sections cut through the teeth show the actual flow of metal conforms with the contour at the root. It is evident that this type of grain structure will provide high tooth strength.

Other advantages claimed include the case of forming teeth all the way up to a protruding shoulder. As a recess for tool clearance adjacent to the shoulder is not required with the Roto-Flo method, and the shoulder is not damaged in any way, greater strength and better bearing surfaces are obtained.

High production rates that can be obtained are evident from a case history where splined shafts of 1⅛ in. dia and 1¼ in. long were formed in 3 sec. Return stroke with the machine empty took 2 sec. Automatic handling of parts will take less than 4 sec. Complete cycle for many parts is less than 10 sec. Parts in this case were rolled from SAE 1037 steel and ranged in hardness from 41 R_c down to the annealed condition. Finish obtained was 3 to 6 mu in. and accuracy was within 0.0008-in. variation from part to part, measured over pins.

MACHINE DESIGN

Basic components of the Roto-Flo machine, besides the rack-type forming tools, are two slides and an extremely heavy C-shaped frame. The two slides, holding the forming racks, are mounted one above the other and are geared together with master racks and a connecting gear. The lower master rack is the prime mover and is driven by hydraulic cylinders. Tool racks are adjustable toward the center of the part to obtain proper size, and are also adjustable endwise for correct relationship with the axis of the part. Parts to be formed are positioned between the forming racks supported between centers or by other suitable means so the shaft is rotated by movement of the forming racks. High tool life is to be expected from these racks since all stresses are compressive and not in shear as in cutting tools. Racks are designed to press deeper and deeper into the parts as they roll together until full depth is reached, and then a few additional rotations of the work are made at full depth. Racks are usually high-carbon, high-chrome steel with the teeth ground on a special Michigan Tool machine designed to give extreme accuracy in spacing and critical angles.

An automatic coolant system is provided for cooling the forming racks and splines under high volume production conditions. The machines are equipped with a safety interlock system that will not permit the forming racks to return until the workpiece has been removed. Also, the working stroke is held up automatically until the part to be splined is properly located between the head and tailstock and the operator's hands are out of danger.

Special automatic loading and unloading devices have been designed to handle high-volume production in line with the present trend toward automation.

Michigan Tool Company, 7171 E McNichols Rd, Detroit 12, Mich

UNIFORM THREADING DEPTH ASSURED!

Here is a GEOMETRIC Collapsing Tap with Ground Thread Chasers and Trip plate that collapses chasers instantly for positive uniformity of thread depth.

These all-purpose universal taps made in eleven sizes will handle practically any tapping job $1\frac{5}{16}$" to $8\frac{1}{2}$" actual diameter — also taper and straight pipe threads. Can be used on most standard machines, both rotary and stationary, without additional parts.

Fast and accurate adjustment by means of positive trip bar binding, ample chip space, and a full flow of coolant to the chasers are popular features among users.

Write for full details. Specify Bulletin S

Greenfield Tap and Die Corporation

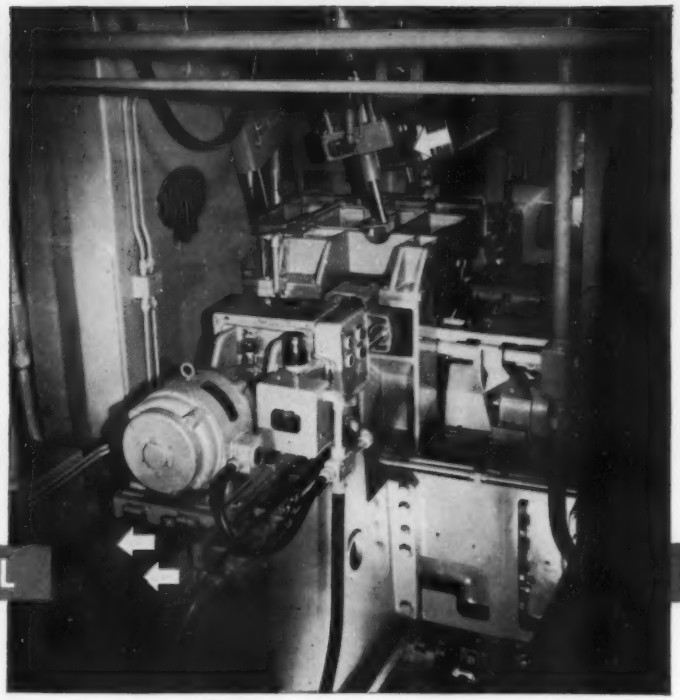
GEOMETRIC TOOL COMPANY DIVISION

NEW HAVEN 15, CONNECTICUT

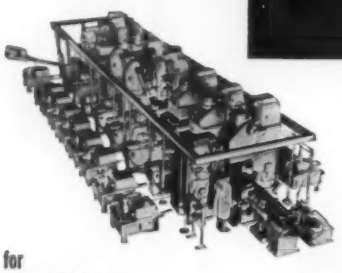
GEO MET RIC

50 Auto Blocks An Hour!

WITH THE HELP OF LUDLUM SARATOGA TOOL STEEL



Ludlum Saratoga was used for the steel ways (note arrows, above) of this giant unit, illustrated at left in a bird's-eye view reduced to miniature size.



Write for BLUE SHEET ON SARATOGA

This concise four-page folder gives all needed handling and shop treatment details on Saratoga. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

Address Dept. AM-54

98 SEPARATE OPERATIONS are carried on by this versatile machine which turns out 50 V8 auto engine blocks an hour. It consists of 18 machining units, each of which is fitted with hardened and ground steel ways of Ludlum Saratoga to guarantee accuracy in production.

MILLING, TREPANNING, DRILLING, counterboring, reaming, chamfering, automatic inspection of holes for depth and removal of chips are the operations performed by this amazing mechanism.

LUDLUM SARATOGA WAS USED BECAUSE its extreme hardness, high resistance to wear, and excellent machinability more than met the customer's high requirements for maintaining accuracy in this huge, multi-station machine.

ALLEGHENY LUDLUM METALLURGICAL SERVICE can solve *your* tool or die steel problems. ● Call your local A-L representative or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

For complete **MODERN** Tooling, call

Allegheny Ludlum

W&D 5155

AL® FINE TOOL STEELS SINCE 1854

why HANNIFIN series "N" cylinders are the recognized standard of the hydraulic industry

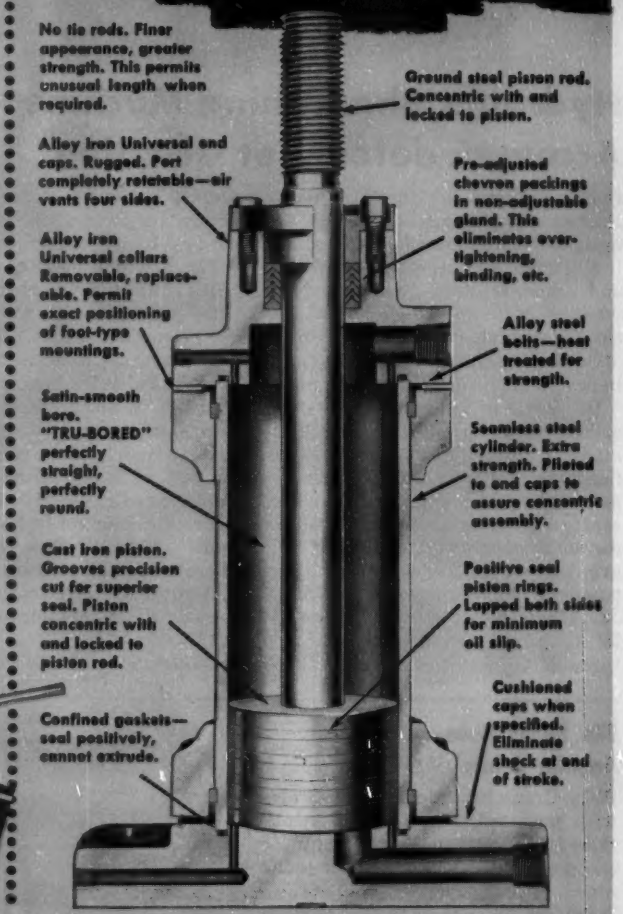
THE MOST COMPLETE STANDARD LINE

Hannifin is your single source for the broadest standard line of hydraulic cylinders on the market. When you need hydraulic cylinders, you'll save time and money by selecting from the complete Hannifin line.

- 12 bore sizes, 1" to 8"
- 11 standard mountings—more than 65 combination mountings
- No tie rods; ideal for long-stroke applications
- Cushioned and non-cushioned
- Double end piston rods available in most styles
- Bodies of heavy-walled steel tubing "TRU-BORED" and honed

WRITE FOR BULLETIN 110
Complete specifications and dimensions

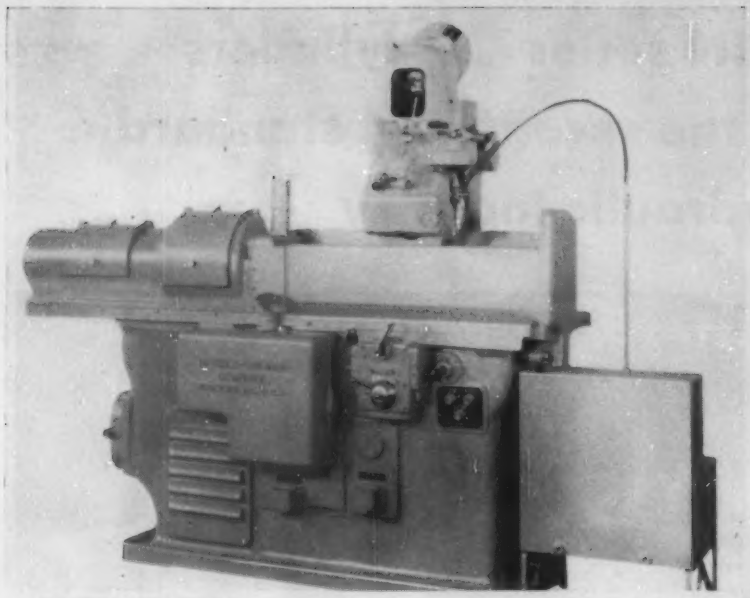
DESIGNED AND BUILT FOR SUPERIOR PERFORMANCE LONGER LIFE


No tie rods. Finer appearance, greater strength. This permits unusual length when required.
Ground steel piston rod. Concentric with and locked to piston.
Alloy iron Universal end caps. Rugged. Port completely rotatable—air vents four sides.
Pre-adjusted chevron packings in non-adjustable gland. This eliminates over-tightening, binding, etc.
Alloy iron Universal collars Removable, replaceable. Permit exact positioning of foot-type mountings.
Alloy steel bolts—heat treated for strength.
Satin-smooth bore. "TRU-BORED" perfectly straight, perfectly round.
Seamless steel cylinder. Extra strength. Piloted to end caps to assure concentric assembly.
Cast iron piston. Grooves precision cut for superior seal. Piston concentric with and locked to piston rod.
Positive seal piston rings. Lapped both sides for minimum oil slip.
Confined gaskets—seal positively, cannot extrude.
Cushioned caps when specified. Eliminate shock at end of stroke.

HANNIFIN

HANNIFIN CORPORATION • 1117 S. KILBOURN AVE., CHICAGO 24, ILLINOIS

AIR AND HYDRAULIC CYLINDERS • HYDRAULIC POWER UNITS • PNEUMATIC AND HYDRAULIC PRESSES • AIR CONTROL VALVES



Hydraulic Sharpening Machine Accommodates Wet Grinding

Barber-Colman No. 10-12 hydraulic sharpening machine has been redesigned to accommodate wet grinding of HSS and carbide-tipped hobs and form-relieved cutters. New wheel spindle and work spindle are carefully protected against effects of coolant. Splash guards and coolant tank and motor are extra equipment.

In addition to fully-protected spindles, wheel spindle has also been made more rigid for finer surface finish on faces of flutes. Wheels are mounted on adapter fitting into tapered wheel spindle. This allows diamond wheels to be trued on tool grinder without destroying their trueness when remounted on No. 10-12. Wheel motor is mounted parallel to wheel spindle and drive is through Gilmer timing belt. New dresser provides easier and more accurate setting of the diamond, according to the manufacturer.

The machine handles a variety of tools with straight or helical flutes, shell- or shank-type up to 10-in. dia by 12-in. face width. All elements of machine cycle can be accomplished automatically by proper settings on controls. When proper settings have been made machine automatically indexes and feeds to remove desired amount of metal from each flute. Table speed is variable by adjusting hydraulic flow control valve. Automatic controls allow one man to operate several machines.

Additional information is contained in manufacturer's bulletin 6216.

Barber-Colman Co, Rockford, Illinois

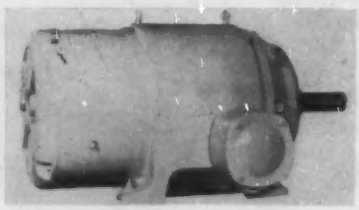
File Bands Have Angular Joints

Boice-Crane has improved hand files with patented joint with a smooth skew that cuts wtihout bump or chatter when the laps pass the work zone.

Surface finish is improved because chatter marks are eliminated.

Chip-clearance spacers under each file further improve performance, and a patented end lock connects and disconnects easier and quicker for inside filing, file installation, or removal.

Boice-Crane Co, 935 Central Ave, Toledo 6



TEFC Motor Ratings Increased to 150 HP

Maximum ratings of U S electrical horizontal totally-enclosed fan-cooled and explosion-proof motors have been increased to 150 hp. Totally enclosed motors, Type SD, are designed for protection against dirt, moisture, oil, and chemicals. Explosion-proof motors, Type SE, are designed for service where flammable gases, volatile liquids, or combustible dusts may be present. SE motors are supplied with Underwriters' Laboratories label for Class I—Group D, and Class II, Groups F and G.

Both type motors are double-enclosed with built-in fan. Additional features include: asbestos-protected windings; stator cover plate which can be easily removed; solid, dynamically balanced, cast-aluminum rotor; Lubriflush bearings for relubrication without disassembly; and normalized castings for permanent machining accuracy.

U S Electrical Motors, Inc, Box 2058, Terminal Annex, Los Angeles 54, Calif

Universal Backstand Idler

Carborundum announces a 61-in. universal backstand idler for all types of wall, bench, and floor, coated-abrasive backstand grinding and polishing operations. Designed for heavy-duty production grinding as well as intermittent light polishing jobs which call for frequent setup changes, idler permits belts of same length to be employed with contact wheels of various diameters.

Varying widths of belts can be used, ranging from ½ to 8 in., due to patented belt-tracking mechanism and sensitive tension adjustments. Linkage type arrangement permits finger-tip manual adjustment of tension and tracking.

Idler is available in two models—432 for floorstand operations; 431 for floor, wall, or bench installation.

Each model is available as individual unit or part of complete packaged backstand installation.

Carborundum Co, Niagara Falls, NY

WHAT IS YOUR TOUGHEST METAL CLEANING JOB?

HAVE YOU TRIED THE NEW OAKITE MATERIAL FOR IT?

Oakite has new materials for many tough jobs

1. Heavy-duty cleaning in tanks
2. Cleaning sensitive metals
3. Etch-cleaning aluminum
4. Washing in pressure-spray machines
5. Electrocleaning zinc-base die castings
6. Cleaning magnesium alloys
7. Putting heavy phosphate coatings on steel in preparation for painting
8. Pickling and conditioning for painting in one operation
9. Cleaning, pickling and conditioning for painting in one operation
10. Stripping paint
11. "Killing" paint in spray booth wash water
12. Drawing and forming

During the past year, the Oakite Chemical Research Laboratory has produced 16 new or improved materials for performing 12 difficult metal-cleaning jobs and related operations.

One of these new materials may be the perfect answer for some metal-cleaning problem that's been giving you a lot of trouble. Just check the list of cleaning jobs, then circle the corresponding number in the coupon, and we'll be glad to tell you about the new chemical designed for your work.

FREE Our 44-page illustrated booklet *"Some good things to know about Metal Cleaning"* has been revised to discuss the applications of the 16 new materials.

OAKITE PRODUCTS, INC., 24 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet *"Some good things to know about Metal Cleaning."*

I am especially interested in some of the metal-cleaning jobs listed in your advertisement. Please give me more information about the new Oakite materials for the jobs indicated by the numbers circled below:

1 2 3 4 5 6
7 8 9 10 11 12

*Name*_____

*Company*_____

*Address*_____

SPECIALIZED INDUSTRIAL CLEANING

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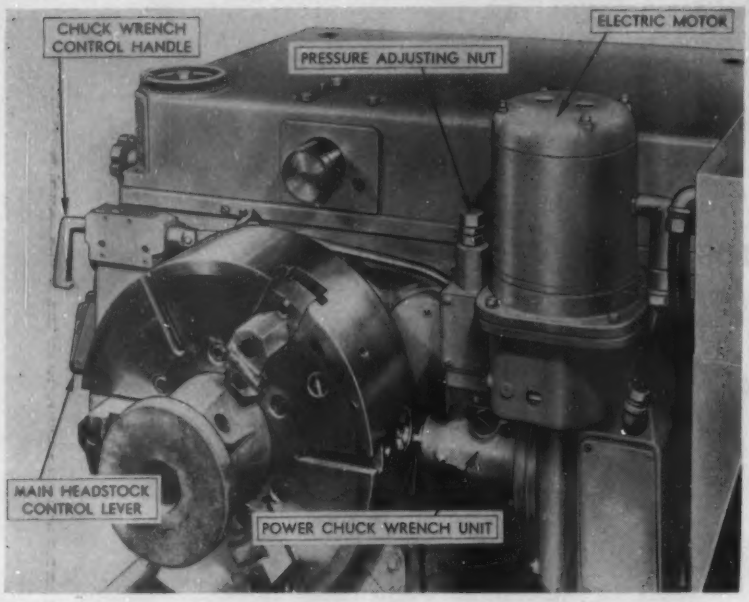
MATERIALS • METHODS • SERVICE

Technical Service Representatives Located in Principal Cities of United States and Canada



Redesigned Power Chuck Wrench Unit for New W&S Turret Lathes

Warner & Swasey has redesigned the power chuck wrench unit for Models 1A, 2A, 3A, and 4A heavy-duty turret lathe recently announced. Power chuck wrench enables operator to chuck heavy forgings with little effort as electric motor operating through control torque clutch does the work. Pressure-adjusting nut regulates gripping pressure of multiple-disk clutch with infinite number of settings to grip heaviest forgings securely or most delicate work without distortion.

Pistol-grip control handle is mechanically interlocked with main control lever on machine headstock to provide safety. Before chuck wrench can be engaged, main control lever must be in brake position. When chuck wrench is being used, main control lever cannot be moved out of brake position.

To provide necessary break-away torque when releasing, a solenoid booster sets torque clutch tight, permitting full motor torque to be applied to chuck for opening the jaws. Reversal of directional solenoid booster for internal or external chucking is obtained by selector switch on machine control panel.

Positioning heavy chucks on 2A, 3A, and 4A machines for engaging power chuck wrench is accomplished by pushbutton spindle inching valve on control panel. Slight pull on pistol-grip handle engages power chuck wrench; twist opens or closes chuck. Another feature is that the wrench provides power chucking without obstructing spindle bore. Bar stock can be gripped as readily as castings or forgings.

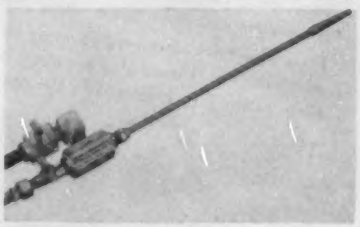
The Warner & Swasey Co, 5701 Carnegie Ave, Cleveland, Ohio

Conveyor Bake Oven Has Purging System

Electric conveyor screen bake oven has built-in purging system to handle aluminized cathode ray tubes. It permits addition of air purge system for processing tubes with temperatures regulated. Heating system is recirculated air type, with heating sections individually controlled.

Conveyor speed is variable with mean speed of 14 ipm. At mean speed, oven will bake approximately 63 tubes per hour.

Steiner-Ives Co, 229 Springfield Rd, Union, NJ



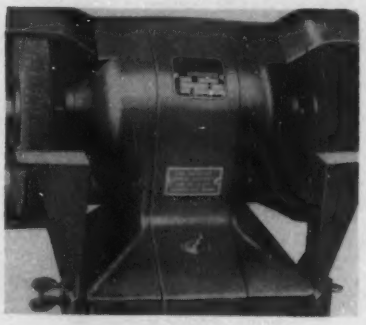
Atom-Lube System Is Now Improved

Atom-Lube uses a powerful air jet to atomize any desired cooling or lubricating liquid from water to heavy machine oils. The system has been successfully applied to a variety of machining operations. It was formerly equipped with a nozzle of soft copper tubing that could be bent to direct the vapor spray to the edge of the cutting tool at the most efficient angle.

This tube has been replaced with a 12-in. nozzle of flexible tubing provided with two interchangeable inner tubes. One, of copper, is used where the nozzle is seldom re-adjusted. The other is flexible plastic and recommended where frequent adjustment is necessary. In addition the system is now supplied with 4 ft of ¼-in. ID plastic hose for coolant supply. The plastic is said to be especially suitable when the coolant is drawn from floor level.

Atom-Lube is a non-circulating system using clean, fresh coolant at all times and is reportedly easy to install, either as a replacement or for machines having no provision for cooling or lubricating.

The Henry G Thompson & Son Co, New Haven, Conn



Black & Decker Line Adds ¼-hp Bench Grinder

A new ¼-hp bench grinder has been added to B&D line of 6-, 8-, and 10-in. bench grinders. Termed a 6-in. standard ball-bearing bench grinder, the model was designed to provide sturdy grinder for intermittent use.

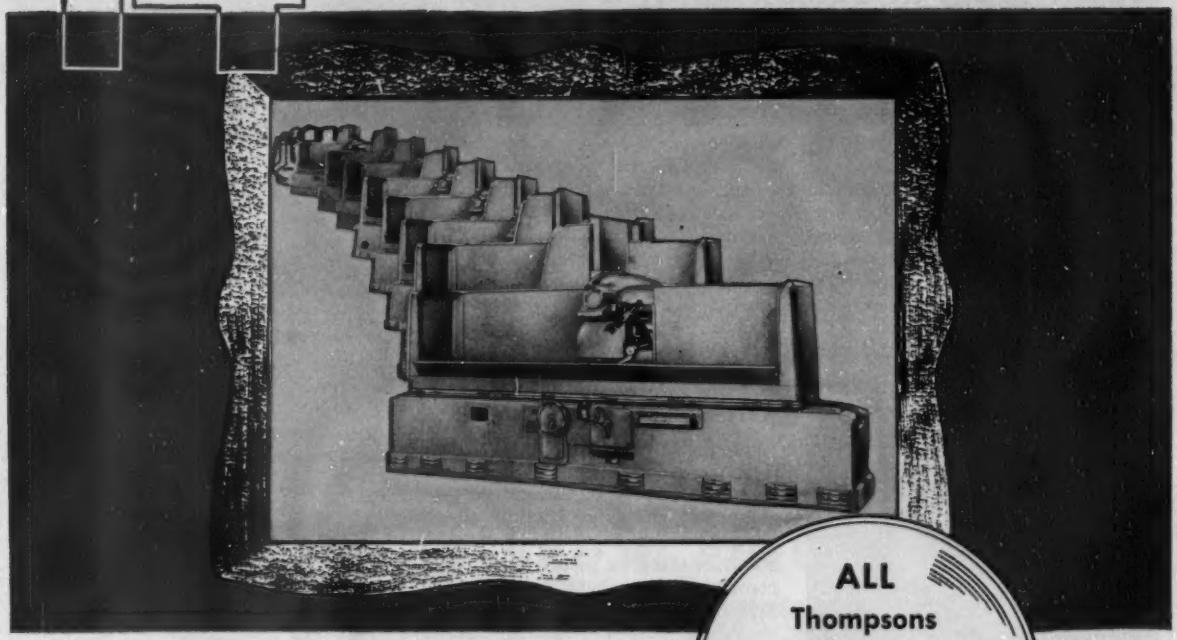
Features include: spindle mounted on permanent, lubricant-sealed ball bearings; two adjustable tool rests which can be moved closer to wheels by adjusting wing nuts at base; overall spindle length of 12 in. Wheel size is 6-in. dia with ⅝-in. base and ½-in. hole. Motor operates on standard AC only and is available rated for 60, 50, or 25 cycles. Standard equipment includes three-conductor cable, toggle switch in base, rubber feet, wheel guards, tool rests, medium grinding wheel, and wire wheel brush.

The Black & Decker Mfg Co, Towson 4, Md

LOOK CLOSELY AT THIS PICTURE
OF GRINDER PRODUCTION AND SEE WHY...

14 *is a lucky number*

for a manufacturer requiring precision grinding



ALL Thompsons operated continuously with much LESS DOWNTIME

that's why

it will pay you to invest in

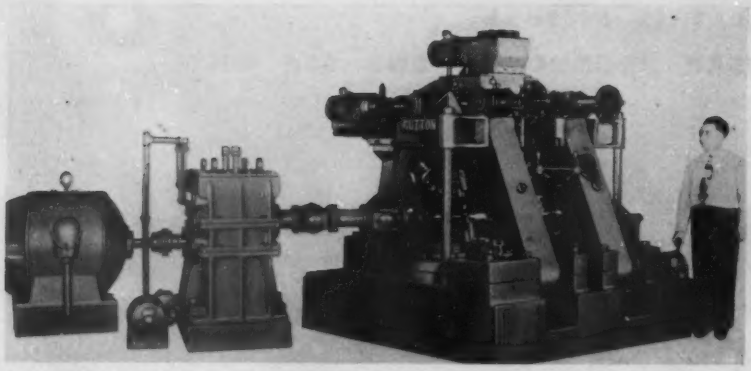
Thompson Grinders

After twelve years continuous manufacture of precision ground products, ten Thompson Surface Grinders proved so efficient and economical that this manufacturer ordered four more machines.

Thompson Grinders are available in a wide range of types and sizes from 6" x 18" to 72" x 384" to meet all production, special or tool room grinding requirements. The Thompson line includes machines from giant Hydrial Way Grinders to automatic Truform Jet Blade Contour Grinders, Dual Rotary Grinders and Broach Grinders.

CONTACT THOMPSON TODAY FOR HELP WITH YOUR MACHINING PROBLEMS

THE THOMPSON GRINDER COMPANY
Springfield, Ohio



New Model in Sutton Line Of Straightening Machines

Model 2 MKTC 7-roll straightening machine was designed for accurate end-to-end straightening of 1¼ to 3¾-in. OD tubes and bars from 1¼ to 3-in. diameter.

Sutton's cluster-roll arrangement is employed in the pass line—three-roll cluster is located at entry end of machine with identical cluster at delivery end. Between clusters, at center of pass line, is unopposed pressure roll.

Featured in the new straightener are automatic roll-angle adjustments with coordinated angling of all rolls, and power-operated adjusting screws. Change-over for sizes is reported to be accomplished speedily, usually taking less than 2 min. All controls are located to be accessible to single operator. Main motor controls are coordinated with table controls to provide operation from convenient position.

Sutton Engineering Co, Bellefonte, Pa

Inside Adjustable Gages

Complete line of inside adjustable gages, ranging in sizes from ⅜ to 2 in., is particularly adaptable for regular use either in toolrooms, inspection, or production departments.

Features reported are: useful not only for inspection of ID's but for checking bell-mouth and out-of-roundness; can be held to micrometer limits regardless of hand pressure or tolerance; gages have solid-piece-collet steel head which is hardened and ground. Each gage is hard chrome plated, anvils are hardened. Sizes under 1 in. are differentiated by gaging increments of 0.100 in.; sizes from 1 to 2 in. by increments of 0.250 in.

Barnaby Mfg Co, 7½ Knowlton St, Bridgeport, Conn

Morse Torque Limiters

Line of compact adjustable torque-limiting overload-protection devices for wide variety of machine drives comprises slip-type friction clutch devices which feature a powdered metal bushing on which such drive components as chain sprockets, V-belt pulleys, or gears, can be mounted. Eleven standard models give max torque capacities from 20 to 620 ft-lb.

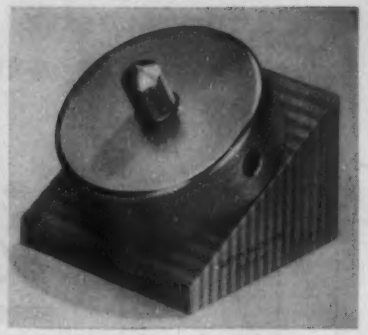
Units act as automatic shear-pin mechanisms and are torque-sensitive, need no resetting.

Standard Morse Type A plain-plate roller-chain sprockets fit the bushings in the various models. Since standard components have been utilized to provide range of torque capacities, special designs requiring specific performance or design characteristics can be assembled by using standard torque-limiter components.

Plate diameters are from 3 to 10 in.; hub lengths from 2 to 3⅜ in. Models can be mounted on shafts from ½ to 2½-in. dia. Standard spacers are provided to permit using sprockets of varying thickness.

Typical applications include drives for materials handling equipment, automated machine tools, and packaging machinery.

Morse Chain Co, 7601 Central Ave, Detroit 10, Mich

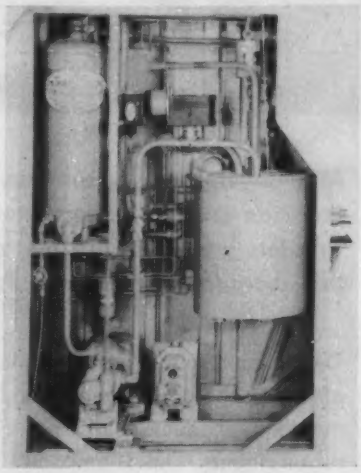


Magnetic Diamond Holder

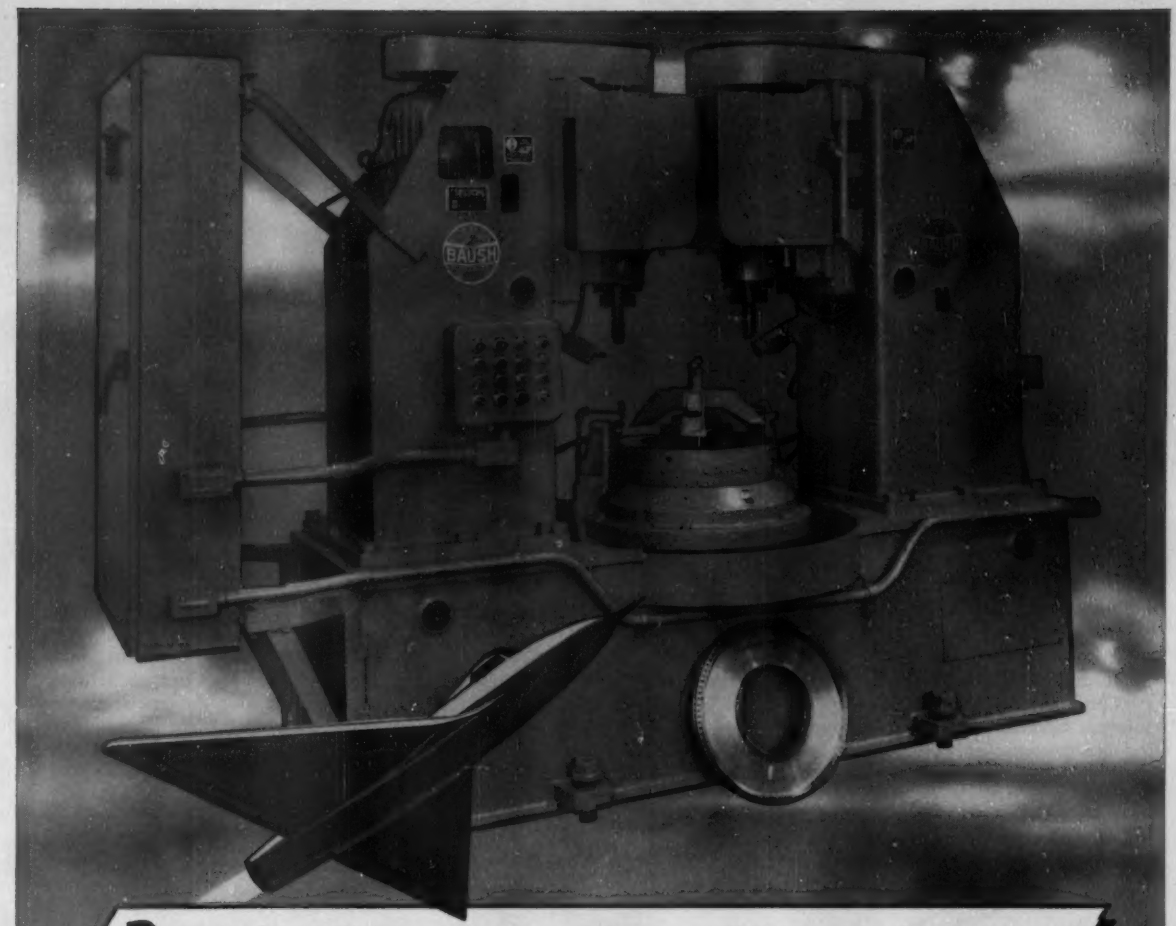
Magnetic diamond holder is said to offer quick and easy way of self-sharpening diamond point through feature of rotation by handling. Replacement of new diamond tool can be quickly accomplished by loosening setscrew on diamond holder. Because laminated base is not pinned or riveted, any angle can be ground for special applications.

The simple construction is said to offer easy cleaning from dirt and grinding grit. Fixture eliminates necessity for mechanical means of turning the diamond tool and magnetic laminated base can be used by itself as angular grinding fixture. Laminated base is ground in 15° and 30° angles.

Anton Machine Works, 1226 Flushing Ave, Brooklyn, NY



LUB-OIL PACKAGE for jet engine test cells pumps oil into engine, holding it at constant temperature and pressure as in operating conditions. Equipment includes air-operated valves, 20-gpm Yale & Towne pump, Cuno filter, heat exchanger, load cell and precision indicators, Parker fittings, explosion-proof motor, and lockout button— *J N Fauver Co, 51 West Hancock, Detroit 1, Mich*



British Jets via BAUSH AUTOMATION

The Baush Vertical Dual Column Quill Feed Cam Unit Machine illustrated was designed and built to do one job, and one job ONLY, on British Jet parts:

> *To drill and ream a total of 97 holes, .220" diam. on an 18.946" diam. bolt circle through a double flange in stainless steel Compressor Rotor Wheels, without being touched by the operator.*

Each of these Baush units is furnished with a single spindle—one unit for drilling and one unit for reaming. Automatic hydraulic indexing fixture with stationary bushings guides drills and reamers.

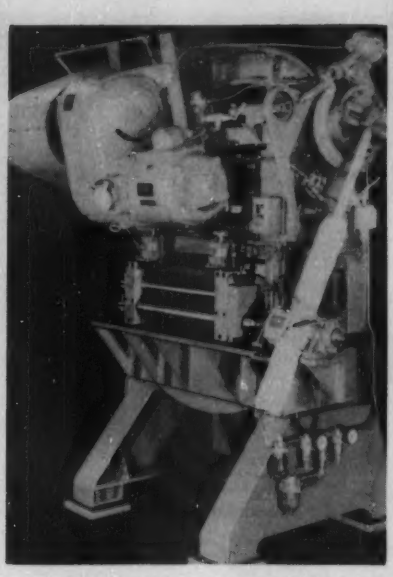
Once the part is loaded into fixture and machine is started by operator, the cycle is completely automatic until all 97 holes have been drilled and reamed.

Why not use Baush knowledge and ingenuity of design to build machine tools for your special machine operations.

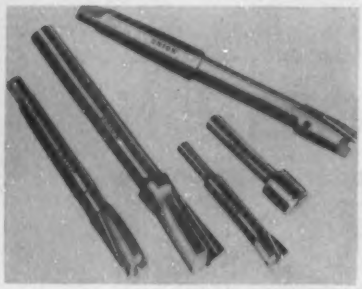
Send us your prints today — there is no obligation.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

COLD-TREATING CHAMBERS produce temperatures to −170 F. Units are equipped with special rotary compressors designed for use with latest Freon refrigerants. Units are available with 1, 4, 6, 9, or 12-cu-ft work spaces. All can be had to produce temperatures to −40, −80, −100, and −120 F; all but smallest are available for producing temperatures to −150 and −170 F. Chambers have corrosion-proof aluminum liners and are Fiberglas insulated. Chambers are designed for pull-down time of two to three hours. Indicating controller automatically maintains preset temperatures — *Tenney Engineering, Inc, 26 Avenue B, Newark 5, NJ*



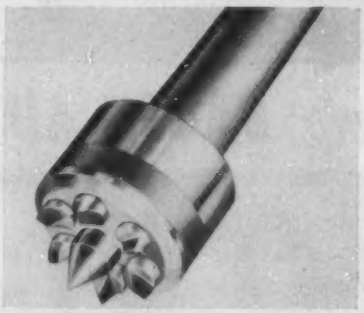
AUTOMATIC PRESS, 40-ton, 28½-in. between uprights uses back-to-front feed; air cylinders clamp stock. Feed length varies from 0 to 13 in. Press has Diebel cylindrical-type ram; 4 bronze bearings support crankshaft. Pneumatic clutch, variable-speed motor permit speed of 72 to 360 spm — *Di Machine Corp, 2701 W Irving Park Road, Chicago 18, Ill*



HSS Counterbores And Spot Faces

HSS counterbores and spot faces with interchangeable pilots have been added to regular line of metal-cutting tools. Four styles of standard counterbores and spot facers are available—long and short set in both straight and taper shank. Two additional styles are made for the aircraft industry—long set and short set with ¼-in. shanks for use with portable equipment. To insure rigidity and permanent alignment, all styles are made with cutter and shank integral and with cutting edges well backed. Pilots are carefully ground from high-grade alloy steel and manufactured in two styles for standard line and aircraft work.

Union Twist Drill Co, Athol, Mass



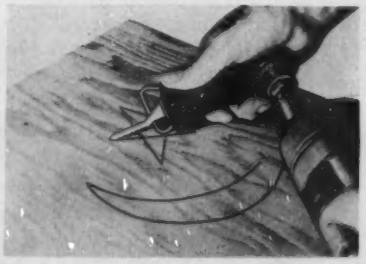
Ze-Hawk Driving Center Eliminates Driving Dog

Driving center which eliminates driving dog has reportedly proven to be effective in reducing fabricating time on tracer and other production lathes and cylindrical grinding machines. It is also well adapted for use with hydraulic tailstock centers. The patented principle eliminates need for driving dogs and makes it unnecessary to stop machine between work pieces.

Constructed with six driving teeth evenly spaced around spring-loaded spindle, the center allows retraction of the spindle (due to pressure exerted on spindle through tightening of work) to force the driving teeth until they slightly imbed themselves in the work. It is reported that the center holds so tightly that even a heavy cut (one that will stop the machine) can be taken without slippage of the center.

Standard capacities run from ½ in. upward; standard Morse Tapers are Nos. 2 to 6. Unit is hardened and ground to guaranteed runout accuracy of ±0.00019 in.

Ze-Hawk Machine Specialties, 3716-20 W Montrose Ave, Chicago 18, Ill

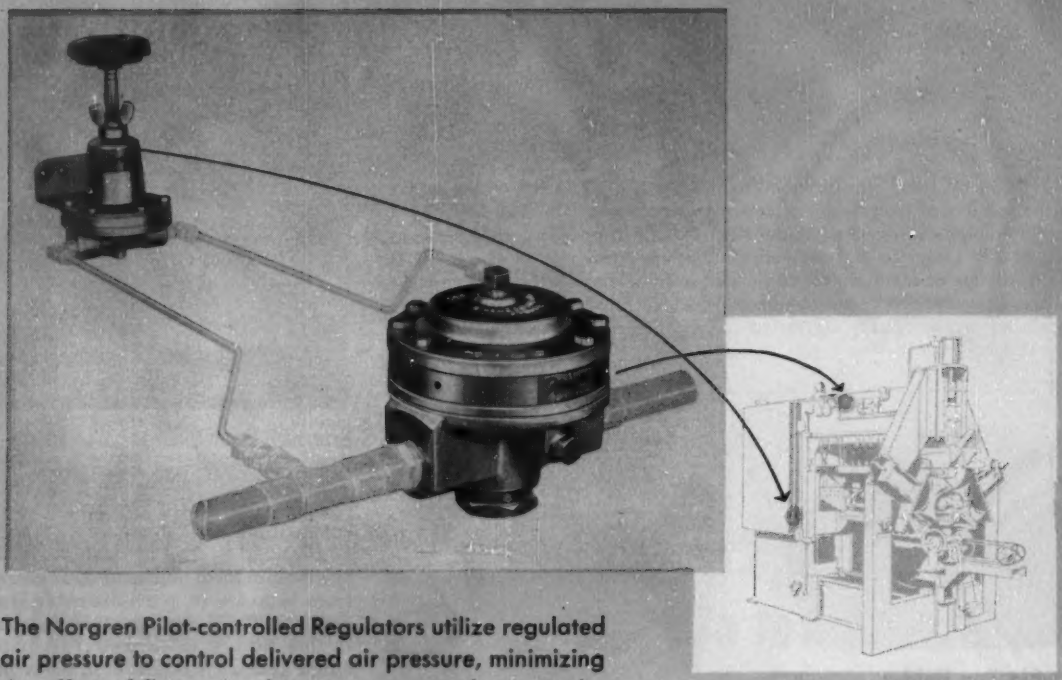


HANDY ANGLE SAW, less than 7 in. long, cuts iron pipe and other types of material. Unit operates on standard ¼-in. drills geared at speed from 1800 to 3500 rpm, mounting at a right angle. Special blades, both bayonet type and tapered type, are supplied. Saw will cut its own starting hole. Price is $13.75—*Price & Rutzebeck, P O Box 30, Hayward, Calif*

Norgren PILOT-CONTROLLED REGULATORS

give

- extreme precision in air control
- flexibility and convenience with remote control



The Norgren Pilot-controlled Regulators utilize regulated air pressure to control delivered air pressure, minimizing the effect of fluctuating line pressure as a factor in delivering uniform working air pressures. No heavy adjusting springs . . . adjustment is easy and precise.

Remote control unit provides maxium flexibility and efficiency in machine design and plant layout . . . Pressure regulator can be placed where it is most effective, and pilot control regulator installed at most convenient location.

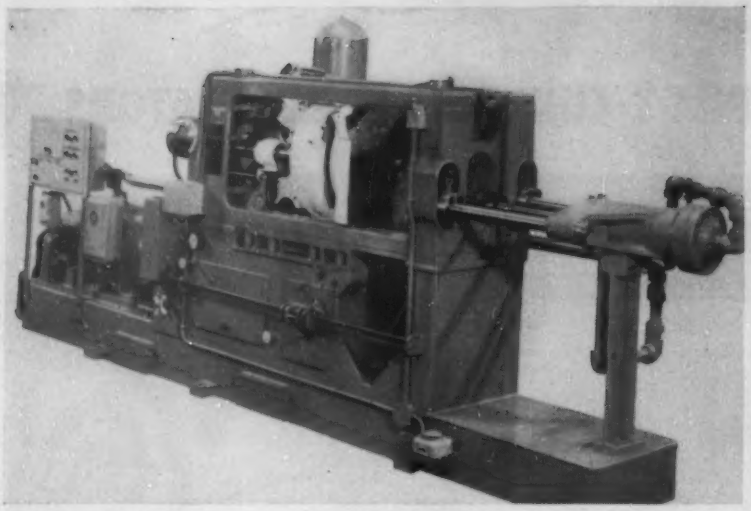
Available in ½", ¾", 1" sizes in both remote control and integral types for 2 psi to 120 psi delivery pressure.

WRITE NOW FOR NEW CATALOG No. 600

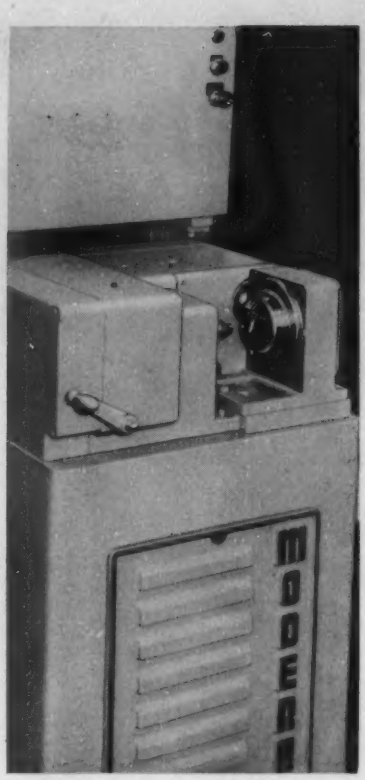
PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 26 YEARS

- Valves
- Filters
- Regulators
- Lubricators
- Hose Assemblies

C. A. Norgren CO.
3436 So. Elati, Englewood, Colo.



DIE-CASTING MACHINE was designed to cast up to 4⅞ lb of aluminum or proportionate weights of magnesium or brass, will accommodate dies up to 25 in. wide or 22 in. high. Designated Model HP-1-C it has a positive toggle clamping pressure of 200 tons. Central die height adjusting screw allows dies to be set to open a fraction of a thousandth of an inch at full clamp, taking advantage of full locking pressure and getting venting. Machine has two accurately aligned shot positions and is readily converted to zinc die casting — *Lester-Phoenix, Inc, 2711 Church Ave, Cleveland, Ohio*



Adjustable Tap Holder With Through-Hole Design

To complement the Tap-Hole-der, American Cam has made the through-hole design available in an adjustable tap holder. In addition to the advantage of a through-hole rather than blind, the new holder provides full adjustability over a total of ¼ in.

Through-hole design eliminates downtime customarily required for cutting off tap shank, makes it unnecessary to remove bushing to extricate broken tap, and prevents identifying information from being ground off the tap shank.

Another feature of the design is the elemination of binding of the actuating mechanism. Shaft contains no working parts to be affected or permanently damaged by excessive tightening of turret-locking bolt. Models are of special alloy steel, hardened, and precision ground.

American Cam Co, Hartford 1, Conn

Portable Visual Unit For Testing Atmospheres

With this unit operator can determine quality of gas being produced by special-atmosphere generator, also quality of atmosphere in special-atmosphere heat-processing furnaces.

Visual tester is also used to detect presence of sulphur. To make a test, operator clamps strip of metal of similar composition to material being heat-treated between two electrodes visible within a Pyrex tube. Temperature of specimen is controlled with rheostat. Gas atmosphere to be tested is then supplied and operator raises temperature of specimen, then after desired length of time it drops to critical temperature at which material would discolor in gas atmosphere being tested.

Testing equipment is housed in metal case 22x9x9 in.; weight, 35 lb.

The Electric Furnace Co, Salem, Ohio

Internal Gear Deburring Machine

Universal internal Burr-Master, designed for deburring and chamfering internal splines, or straight sided or involute form helical or spur gears from ⅝ to 3½-in. pitch diameter can also handle internal splines or gears having from 9 to 42 teeth. Its patented action chamfers both sides of the tooth and the root at one time at the rate of 5 teeth per sec. Depth of cutting stroke is infinitely variable; change-over enables production to be shifted from one gear to another with minimum time.

Long tool life and mininmum shutdown are reportedly assured by use of three- or four-cutting edge, circular-type form tool. There is no need for fine adjustment as tool is positively positioned against a stop; no form grinding is required.

Part is loaded on spline drive and fed forward into holding fixture as cycle control lever is actuated. Forward motion of lever energizes the control circuit which starts drive motor and timer in control panel. Conventional camming provided with machine will take care of most jobs. Unit can be furnished with special interchangeable camming. A 220/440-volt, ½-hp, three-phase motor drives machine.

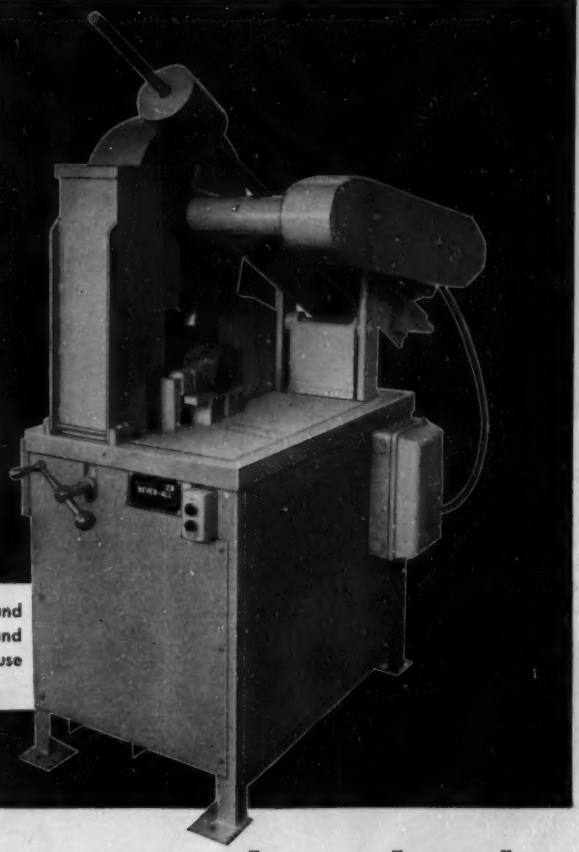
Modern Industrial Engineering Co, 14230 Birwood Ave, Detroit 38, Mich

Campbell Abrasive Cutter

an ACCO product

New Model 28 Campbell Sever-All Dry Cutter

- Compact
- Portable
- Ideal for contract or construction work



CAPACITY: Solids up to 4" x 4" square, angles and channels to 8", tubes and pipes to 4" O.D., 4" angles and channels and 4" O.D. pipe at 45° angles. Based on use of 18" cutting wheel and 10 H.P. motor.

Here's a versatile cutter you can take to the job

• This new CAMPBELL Model 28 SEVER-ALL Abrasive Cutter is a dry-cutting machine which combines the capacity for a wide variety of cutting operations with a compactness which permits a portability seldom found in cutters of its type and capacity. It is ideal for cutting all types of material in contract or construction work. Can be supplied with work stop and with wheels for easy movement from job to job.

From front to back, the SEVER-ALL measures but 56". It is only 32" wide and 62" in height. Other important features include:

1. Work clamped on both sides of cut by hand-operated, self-centering work holders. Can be supplied with foot-operated treadle.

2. Time of cut is approximately 3 seconds per square inch of material.

3. Operator safety provided by complete enclosure of cutting wheel during operation—except for openings to clear the work.

4. Lowering of guard permits accurate location of work, permits long pieces to be placed in machine without threading through.

This Model 28 SEVER-ALL cutter is the newest of a long line of CAMPBELL Abrasive Cutters which provide many exclusive features. CAMPBELL field engineers are conveniently located to consult with you on ALL your cutting problems. Write today for specifications on the SEVER-ALL or **Bulletin DH-301** on the CAMPBELL Abrasive Cutting Method.

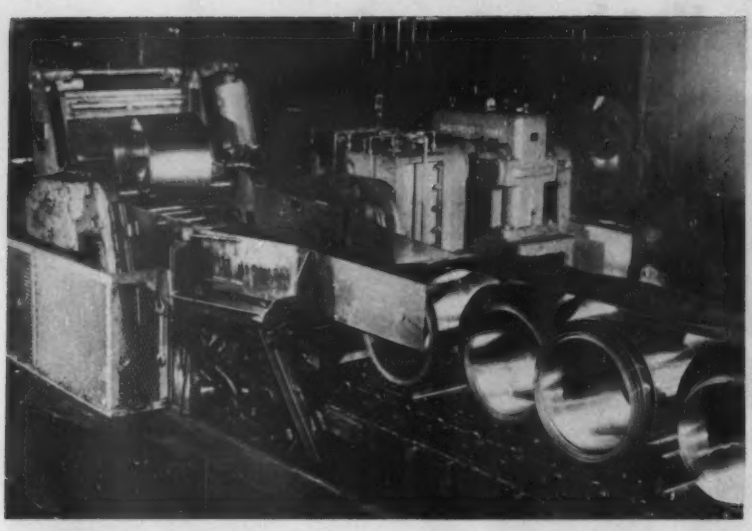
ACCO

Campbell Machine Division

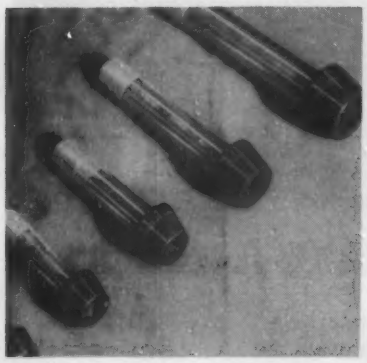
AMERICAN CHAIN & CABLE

923 Connecticut Avenue, Bridgeport 2, Connecticut

Wet and Dry Cutters and Nibblers



BLISS UPCOILER, installed at American Brass plant, coils 0.400-in.-gage brass and silver alloys in widths to 25 in. It is reported that savings in machine time and handling costs have been achieved. Coiler is of three-roll pyramid type, and its capacity ranges up to 0.4375-in. thickness and to widths of 28 in. on certain mild steels. A feature of the coiler is that it produces straight tails which serve as flat sticking ends to facilitate subsequent passing — *E W Bliss Co, Salem, Ohio*

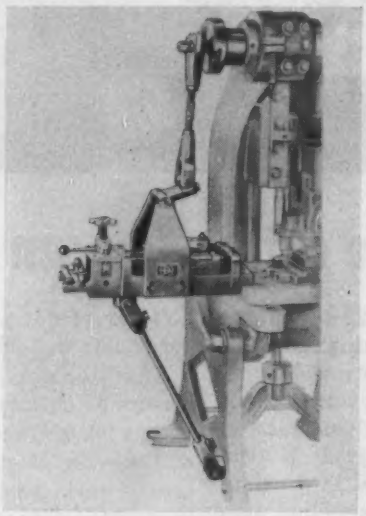


New Bolts Have High Tensile Strength

Standard Pressed Steel reports that it is producing precision bolts with rated tensile strength of 200,000 to 225,000 psi. Primarily designed for airframe assemblies, these high-tensile bolts are reported to meet the challenge of increasing shock and vibrational stresses encountered by sonic and supersonic aircraft. SPS designs special tools and equipment to develop the ability to cold roll finished threads into exceptionally hard steel.

Bolts come in twelve sizes ranging from ¼ to 1½-in. diameter. They are forged from 8740, 4340, and 4140 high-alloy steels. Bolts up to 1¼ in. are cold forged; larger sizes are hot upset forged.

Standard Pressed Steel Co, Jenkintown, Pa



Slide Feed Uses Check Roller System

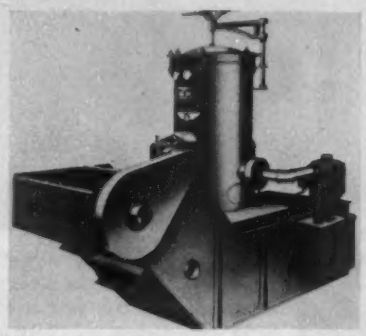
Durant slide feed uses the check roller system for positive stock control. Both rollers are of hardened steel and rotate in ball bearings at each end. Stock-support roller for heavy stock lifts off when not needed.

Check roller release is provided for fast setting—pushing handle to side opens rollers, centering lever brings rollers in contact with stock at same pressure as when released. One-way clutch inside lower check roller is actuated by series of springs, steel balls, and rods. When roller direction is reversed, these elements jam together against roller casing to prevent reverse movement.

Gripper blade in feed block is tipped with carbide. Positive adjustments are possible with locking adjustment screw controlling vertical position of blade. Lock screw allows engagement and disengagement without losing adjustment. Two feed stop screws at forward end of feed are outside the guide rods, away from possible interference. All wear points are equipped with standard cast bronze bushings.

Unit is available in seven sizes.

Durant Tool Supply Co, 136 S Water St, Providence 3, RI



Filtering System Is Three-Phase

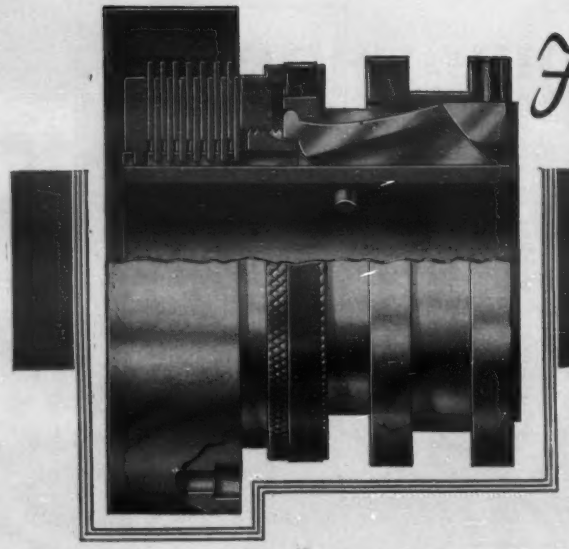
Magna-Flomaster three-phase filtering system clarifies mineral cutting oils or water soluble coolants. Contaminated oil first enters tank where heavier solids are allowed to settle. Next, lighter ferrous particles are attracted to magnetic plate; oil is then passed through full-flow cartridge type filter. Unit is available in three models with flow rates ranging from 20 to 40 gpm.

Clarifiers are designed primarily for use where metallic and grit particles are relatively small. Particles of 5-micron size are removed from fluid. Process is continuous and progressive stages are mechanical.

The flow tank itself, a welded steel reservoir, provides a detention period of from 3½ to 7 min, during which heavier solids settle out. Dirty liquid is drawn across surface of Magna-Flo plate which contains shielded Alnico permanent magnets. Pair of endless conveyor chains with scrapers attached at intervals remove accumulation of particles from magnetic plate.

Hoffman Flomaster cartridge-type filter utilizes patented 7x18-in. throw-away cartridge which fits over 2-in. OD perforated metal manifold tube.

U S Hoffman Machinery Corp, Syracuse, NY



For **MACHINE TOOLS... MACHINERY... PRODUCT DESIGN...** *Specify*

MAXITORQ *floating disc* CLUTCH

There are 2 basic types of Maxitorq clutches . . . Single and Double. Above is a cut-away view of the single type . . . the double is shown at right. Each is available in 8 capacities (wet or dry) from ¼ to 15 h.p. @ 100 r.p.m. And from 13 to 788 max. working torque ft. lbs. Pulley type, Ring type, or Cut-off Coupling Driving Cups are also available.

The Maxitorq automatic overload release clutch (up to 5 h.p.) is extremely useful for protection of machine and product against accidental overload in high speed production. Special bulletin on request.

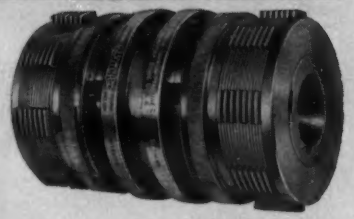
Send for Catalog No. AM-6

We hope you haven't minded turning this magazine around, but it was the only proper way to include the picture at the bottom. It clearly shows all parts of a single Maxitorq Clutch...and how easy it is to adjust it, take it apart, and assemble it...manually.

Each and every part contributes to smooth, positive, trouble-free clutch operation. The Separator Springs between each pair of inner discs keep them "floating" in neutral...preventing drag, abrasion, and heat. A Locking Plate locks all discs against the tension of the Separator Springs. The Adjusting Ring provides the means for obtaining the desired shifting pressure.

These are some of the reasons why we counted 69 machines, exhibited at the last Machine Tool Show, that were equipped with Maxitorq floating disc clutches. Send for our 50th Anniversary Catalog...and see how Maxitorq answers your problems for dependable power transmission.

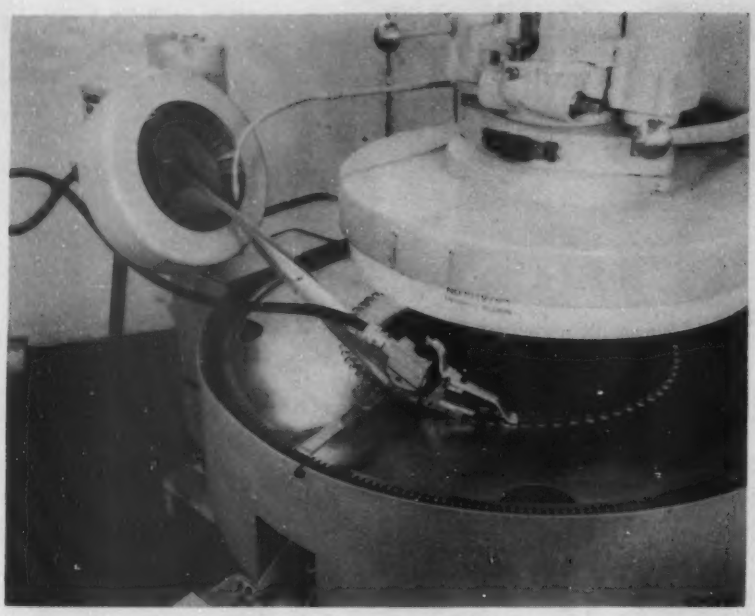
THE CARLYLE JOHNSON MACHINE CO.
MANCHESTER, CONNECTICUT



Compact, rugged construction and precise machining . . . flat, true surfaces on engaging faces of the discs . . . provide not only the exacting accuracy required in important industrial machines, but also long, profitable service life.

Our engineers will give you personal assistance for correct selection of the right clutch and installation for your specific requirement.

ALL ASSEMBLY, DISASSEMBLY AND ADJUSTMENTS ARE MANUAL. CLUTCHES SHIPPED ASSEMBLED ON THE BODY.



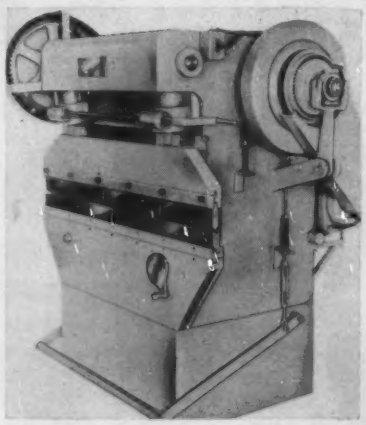
TRANSFER-TYPE CRANKPIN GRINDER accomplishes all grinding and handling functions automatically and continuously. As crankshaft proceeds from one grinding station to next, succeeding journals are ground until shaft is finally deposited on conveyor line. Another feature is automatic truing of grinding wheels at predetermined intervals. After wheel is trued, automatic compensation is made in wheel-feed mechanism. An arrangement is also available for automatically inspecting each crankpin after it is ground. Machine is built in sections, each space section supporting two grinding wheelheads and each wheelhead carrying a 42-in.-dia grinding wheel driven by its own motor. Wheel feed is operated hydraulically with rapid motion by cylinder and piston which moves complete unit. Actual feed for grinding crankpin body is accomplished by large diameter feed screw revolved in its nut. Movements of transfer equipment are operated hydraulically with electrical interlocks. Norton states that it estimates this grinder allows one man to do the work of five to seven men, using conventional semi-automatic grinding machines—*Norton Co, Worcester 6, Mass*

Production of Vacuum-Melted High-Temperature Alloys

Vacuum Metals Corp is beginning first commercial production of vacuum-melted high-temperature alloys and expanding production of high-purity nickel alloys for electronic tube construction. It is stated that the application of these vacuum-melted high-temperature alloys gives promise of not only better performance of the alloy in jet engines, but also increased ease of fabrication and higher yields. Vacuum melting permits the precise control of very dilute alloying additions as well as of trace impurities to give tubes of improved dependability.

Ferrovac-52100, a vacuum melted low-alloy steel, is being used by manufacturers of high-quality ball-bearings. Other vacuum-melted alloy steels for applications requiring high-fatigue strength are under test.

Vacuum Metals Corp, 70 Memorial Drive, Cambridge 42, Mass



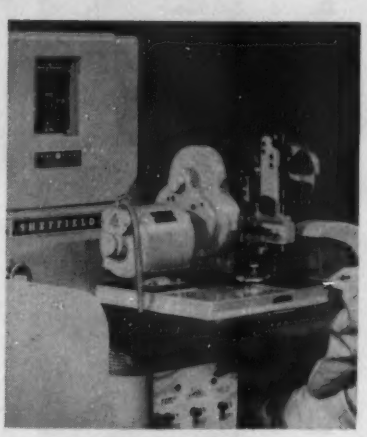
Sheet Metal Bending Brake

Sheet metal bending brake for production runs is termed Connecticut Press Brake. Powered by ¾-hp motor, machine will bend 16-gage mild steel 4 ft wide over ½-in. die opening, or 10-gage, 2 ft wide over 1⅛-in. die. Brake has speed of 40 fpm with deflection minimized by specially designed support of main crank shaft at both ends. Reversing switch permits ram to be backed off in case of jamming.

Special feature is accurate back gage built in as standard equipment and operated from front to permit accurate resetting.

Standard features include Oilite bearings on all shafts, anti-friction bearing of flywheel, and extra wide 32 in. clearance between the two side frames. Max die space is 7 in., stroke 2 in., and adjustment 1½ in., giving shut height over die block of 3½ in.

Connecticut Press Brake, W Whitney Stueck, Inc, Old Saybrook, Conn



Automatic Welding Machines Are Disk and Point Types

Both disk- and point-type automatic welding machines are included in line of products manufactured by Sheffield.

These highly specialized machines are used for high-speed, low-cost automatic welding of precious and semi-precious metal contacts to leaf springs, small contact arms, and other instrument components. Gold, silver, platinum, palladium, and iridium are a few of the metals used for the weld.

Point contacts may vary in shape from a small pin point to dome shape of 0.070-in. diameter at base and height of 0.060 in. The point welder will handle wire diameter from 0.022 in. up to maximum of 0.075 in. on fine silver. Disks can vary in diameter from 0.025 to 0.187 in. in fine silver, or to 0.125 in. in other materials.

Both machines have a production rate from 1200 to 2400 contacts per hour. Welding current is controlled with Thyratron unit.

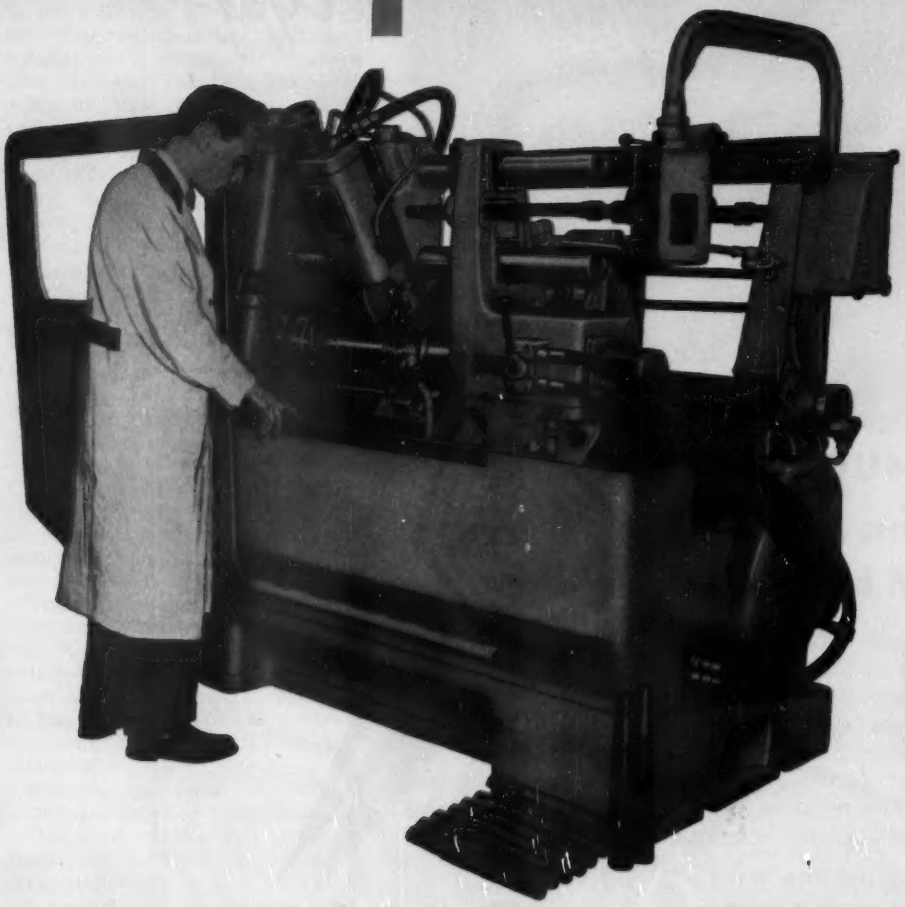
The Sheffield Corp, Dayton 1, Ohio

IT'S COSTING YOU MONEY NOT TO BUY IT!

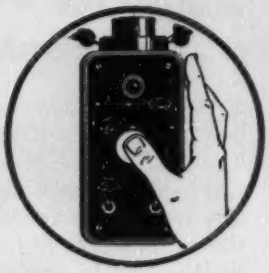
PILOT

COMPLETELY AUTOMATIC

high speed HYDRAULIC COPYING LATHE



The machine that amazed visitors at the A.S.T.E. Exposition



YOU'RE LOSING MONEY EVERY DAY on all the parts you turn with your present equipment because they would cost less on the H.E.B. Pilot. In today's competitive market you cannot *afford* to use yesterday's methods and machines.

The Pilot copyturns faster and with less tooling and labor; produces better finish and accuracy, considerably reducing grinding costs. Spindle speeds to 3,000 RPM; motors to 60 HP. Completely built in Lansing, Mich. by Industrial Metal Products Corp.

Write, wire or telephone us now for a demonstration or comprehensive catalog.

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"THE WAY TO TURN"

H.E.B. MACHINE TOOLS, INC.

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COPYING LATHES • ENGINE LATHES WITH COPYING ATTACHMENTS • CARBIDE TOOL GRINDERS • RADIAL DRILLS

When you figure cost, accuracy and long range performance, you'll specify---

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SQUARING SHEARS

Builders of Precision Metal Working Machinery
POWER SQUARING SHEARS • FOOT and AIR-POWER SQUARING SHEARS
ALL STEEL BENDING ROLLS
See your dealer or write to factory
Wysong & Miles Co. • 627 Fulton Street • Greensboro, N. C.

Predetermined Electric Counter

Model 5-SP-1-MF Productimeter is an electrically operated predetermined counter for controlling production on any electric counting installation to the exact quantities required.

Available in either four or five figures, models are actuated by electric impulses to close or open a switch at any preset count from 1 to 9999 or 1 to 99999 respectively. Metal hinged cover provides quick access to predetermined wheels for easy setting.

Switch capacity is 5 amp at 125 or 250 v 60 c ac; 0.5 amp at 110 or 200 v dc, non-inductive load; and 0.3 amp at 110 or 220 v dc inductive load. Standard voltage is 105 to 120 v 60 c ac; other voltages available on request.

Over-all dimensions are 4⅜ in. wide by 2⅛ deep by 2⅝ high. Weight is 1¾ lb; speed is 600 counts per minute. Further details available in Bulletin 502.

Durant Mfg Co, 1945-B N Buffum St, Milwaukee 1, Wis

Indicator Stop

Turret indicator stop has been developed as aid in duplication of machined parts requiring close tolerances. Unit is named Sure-Stop and its purpose is to maintain length tolerances and omit possibility of operator error brought about by elements of pressure and feed. While hand pressure varies, Sure-Stop records correct pressure on indicator.

Unit is mounted on carriage of lathe and stop mounts on the lathe bed. It has five quickly and easily adjustable stops which permit wide range of machining possibilities. Added fine adjustments can be made on drill rods for ease in obtaining close tolerances.

Indicator has range of 0.150 in. and is graduated in 0.001 in. spaced ¼ in. apart. Center dial reads accumulated rotations of arrow in thousandths.

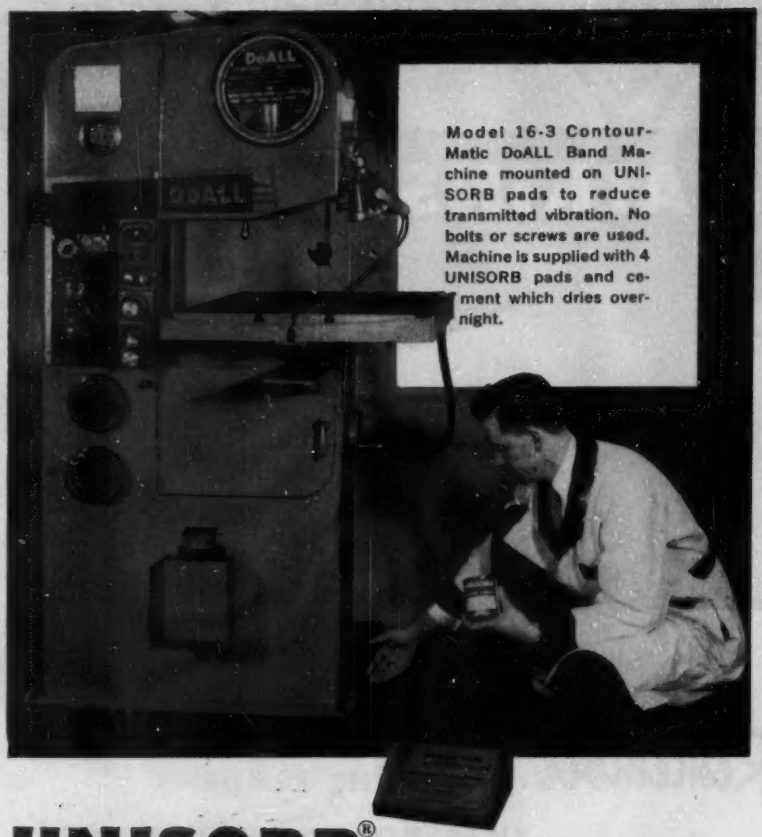
D-S-C Machine Co, 27 Bertel Rd, Mount Vernon, NY

Copper Shop Hammer

Safe-T-Hammers have heads of tough, soft copper alloy, which will flatten but not fracture, molded on light-weight tubular steel handle. Cross-section of handle is oval and grip section is knurled. Head end has T-lock to key and to cast copper.

Design eliminates wedges, wooden handles and provides longer period of use.

Univertical Machine Co, 4841 Meyers Rd, Detroit 27



Model 16-3 Contour-Matic DoALL Band Machine mounted on UNISORB pads to reduce transmitted vibration. No bolts or screws are used. Machine is supplied with 4 UNISORB pads and cement which dries overnight.

UNISORB® MOUNTING PADS are supplied with the new DoALL Contour-Matic Band Machines...

New Contour-Matics are installed on UNISORB pads, without floor drilling, without bolting the machines in place.

Practically every type of production machine can be quickly installed on UNISORB pads. Labor savings are as much as 20%. Transmitted vibration is reduced 60% to 85% and you get quieter operation.

For full information about this modern way to install your machines, return the coupon for your free copy of the booklet about UNISORB.

LOOK FOR THE RED CENTER AND UNISORB BRAND MARK

The **FELTERS** Company
200 SOUTH STREET, BOSTON 11, MASS.
Offices: New York, Philadelphia, Chicago, Detroit, St. Louis
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RETURN COUPON NOW! Please send me my free copy of the book: "Facts About Anchoring Your Machines with UNISORB".

Name..... Title.....
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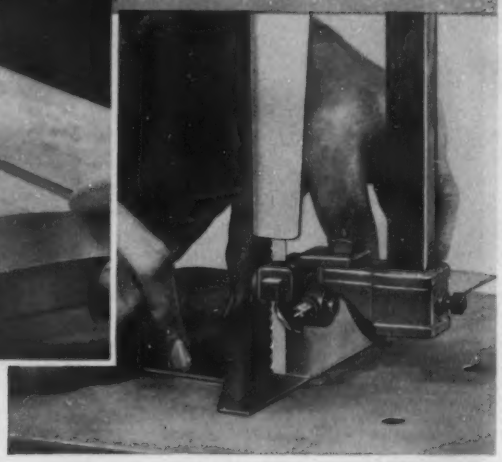
Company.....
Address.....
City..... Zone..... State.....
Return to: The Felters Co., 200 South St., Boston 11, Mass.

Strike up band saw profits..

...WITH ATKINS Silver Steel!®



Remember... IT'S THE BLADE THAT DOES THE CUTTING!

BUY ATKINS Silver Steel® Metal Cutting Bands

AND GET:

- The *Right* Blade for Contour or Cut-Off Sawing
- The Finest Saw Steel for Longer Cutting Life
- The Correct Tooth for Fast, Free Cutting
- Lowest Maintenance Costs.

CONVENTIONAL TOOTH . . . for top performance in the toughest ferrous metals

CURLED CHIP BUTTRESS TOOTH . . . the original, Atkins Skip Tooth . . . for cutting all types of non-ferrous metals, plastics, fibre and wood

ATKINS Silver Steel SAWS

ATKINS

B-W

ATKINS SAW DIVISION · BORG-WARNER CORPORATION
INDIANAPOLIS 9, INDIANA

Small-Size Vibrating Conveyor Has Large Handling Capacity

Small vibrating conveyor, mounted on springs, is designed to convey diversified materials at a speed of 38 fpm. Pans with special coating, or of stainless, are available for handling extremely corrosive and abrasive materials.

Standard pans are 4 in. deep and can be supplied in widths of 8, 12, or 18 in., with or without top covers. Single-drive, 1-hp model is available in lengths ranging from 20 to 100 ft; transfer sections can be used to couple two or more units in tandem.

Model, with instruction sheets for easy assembly, can be set up or moved in less than an hour. Price ranges from $845 to $1725, depending on length and width of pans.

Hewitt-Robins, Inc, Stamford, Conn

T/S-21 Bearing Grease Has No Melting Point

Special lubricant for ball and roller bearings is claimed not to break down or bleed even at very high temperatures and can be pumped at below 0 F. Material is completely water resistant and has high degree of adhesion to metal surfaces. A similar grease designated T/S-21 S is meant for light high-speed bearings in applications where odor, taste or stain would be damaging.

Greases are available in 400- and 100-lb drums, 25-lb pails, and 5- and 1-lb cans.

Tri-State Petroleum Co, 81st & Eastwick Ave, Philadelphia 42

Air-Powered Printer Fills Color on Products

Colors are applied to depressed or sunken design and lettering on metal plates by Acromark color filling and printing machine. Unit is powered by plant air supply of 75 psi or more. Size of Model No. 507 is 30x12x8 in. Unit has double capacity of older hand model and prints at speeds from 15 to 120 pieces per min.

The Acromark Co, 8-13 Morrell St, Elizabeth, NJ

Engler AC hour log is a precision instrument developed to provide continuous record of running time for all industrial machines operating on ac current. Device is housed in a steel case, which is dustproof, with interior lighting and on-and-off switch; readings can be taken at a glance.

Engler Instrument Co, 250 Culver Ave, Jersey City, NJ

NOW available

Clark's HYDRATORK DRIVE CARLOADER

The revolutionary HYDRATORK DRIVE lift truck is now available in Clark's 3000-5000 lb. Carloader. The new clutchless, torque converter transmission has already won many friends among users of Clark's 6000-7000 lb. Utilitrucs. The basic benefits of this Clark-built transmission are:

1. Lower cost: no gear clash, no clutch problems, excellent serviceability.

2. More power: faster, smoother get-away, better gradability.

3. Less driver fatigue: finger-tip direction control, no clutching or shifting.

Send for FREE Booklet

The free booklet shows detailed disassembled views of the HYDRATORK DRIVE, explains how it works. Clip the coupon to your company letterhead and we'll send it to you.

CLARK EQUIPMENT

Industrial Truck Division
CLARK EQUIPMENT COMPANY
Battle Creek 3, Michigan

☐ Send HYDRATORK DRIVE booklet

Name_____

Firm_____

Address_____

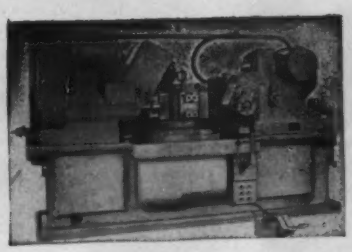
City_____ Zone_____ State_____

Here's what is meant by

"1-2-3"

in the

GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE



The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, *without changing set-up* or reheadling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

For complete details ask for illustrated bulletin. Send samples of your work for time and cost estimates.

GOSS and DE LEEUW

MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

GOSS & DELEEUW QUALITY PRODUCT-QUANTITY

Super-Precision Test-Center

Universal test-center, called Surfcenter, may be used on any surface plate in vertical, horizontal, or angular position without need for special indicator bases or clamping on angle plates. Can be placed on either end and remain square to centers, and when placed on either side, remain parallel to centers.

V's are held to a guaranteed accuracy of 0.0002 in. for parallelism and squareness to sides and ends. Sine pin holes are held within 0.0001 in., and parallel and square to sides, ends, and V's. Supplied with three centers, long, short, and spring-loaded; swings a 5-in. dia. Maximum capacity between centers is 7 in. Portable, 21-lb unit is 12 in. long. Details in Bulletin 143.

Inspection Devices Co, 5636 Lake Park Ave, Chicago 37, Ill

Wet Blast Equipment

Wet blast machine Model 34 is reported to incorporate new improvements, making equipment more economical to maintain and increasing production runs. It will polish surfaces when tolerances are no more than 0.0001 in.

Incorporated is new vertical-type pump which has chrome-plated impeller and shaft with long wearing ability. Hopper is built so complete changeover of abrasive is cut to a minimum. Manufacturer also states that less head space is needed to install the equipment, much unnecessary piping has been eliminated.

Wet Blast Manufacturing Co, 3230 E. Woodbridge, Detroit 28, Mich

Mobile tool stand, known as Model 426 in the Carry-Tool line, designed for assembly, inspection, and maintenance, is made of heavy-gage steel, mounted on 2½-in. swivel casters, with cabinet and two drawers. Top is a recessed tray. Unit has same overall dimensions as previous models, 422 and 424, and is 14 in. high. Each drawer is 5 in. high, with roller suspension and individual padlock attachment.

Standard Pressed Steel Co, Jenkintown, Pa

Solenoid-controlled, pilot-operated 4-way valve, designated QF, QM, QJ Series, is available in 2-position (no spring), spring-centered, and spring-offset models. Specifications: ½ and ¾-in. ips; for volumes up to 20 gpm; operating pressures up to 2000 psi.

Double A Products Co, Manchester, Mich

Another New Delpark Development

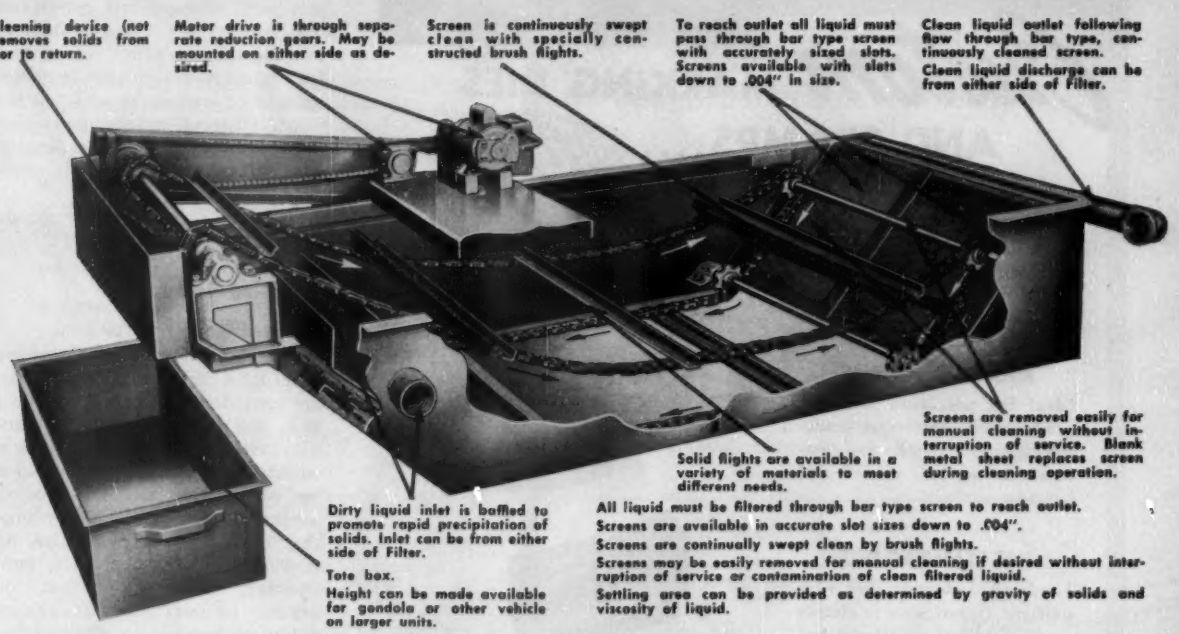
THE

COMBINATION

Delpark Settling and Filter

SYSTEM

FOR CONTINUOUS REMOVAL OF CHIPS, HEAVY SOLIDS AND RELATIVELY FINE SOLIDS TO .004" SCREENING


Special cleaning device (not shown) removes solids from flights prior to return.
Motor drive is through separate reduction gears. May be mounted on either side as desired.
Screen is continuously swept clean with specially constructed brush flights.
To reach outlet all liquid must pass through bar type screen with accurately sized slots. Screens available with slots down to .004" in size.
Clean liquid outlet following flow through bar type, continuously cleaned screen.
Clean liquid discharge can be from either side of Filter.
Screens are removed easily for manual cleaning without interruption of service. Blank metal sheet replaces screen during cleaning operation.
Solid flights are available in a variety of materials to meet different needs.
Dirty liquid inlet is baffled to promote rapid precipitation of solids. Inlet can be from either side of Filter.
Tote box.
Height can be made available for gondola or other vehicle on larger units.

All liquid must be filtered through bar type screen to reach outlet.
Screens are available in accurate slot sizes down to .004".
Screens are continually swept clean by brush flights.
Screens may be easily removed for manual cleaning if desired without interruption of service or contamination of clean filtered liquid.
Settling area can be provided as determined by gravity of solids and viscosity of liquid.

The DELPARK Settling and Filter System is engineered for the filtration of particles .004" or larger. It is made for the filtration of liquids of varying degrees of viscosity containing solids of different particle sizes and widely differing weights. Size of the equipment is dependent upon the settling rate which in turn is governed by the gravity of the solids and the viscosity of the liquid. This factor determines the retention period for a given rate of flow.

Write today for more information on this newest development in DELPARK Industrial Filtration.

Delpark INDUSTRIAL FILTRATION

BACKED BY MORE THAN 30 YEARS EXPERIENCE IN INDUSTRIAL FILTRATION

INDUSTRIAL FILTRATION COMPANY, 115 INDUSTRIAL AVENUE, LEBANON, INDIANA

Standard MARKING DIES AND STAMPS.... by Parker

STEEL NUMBER AND LETTER SETS

Complete sets in 17 different sizes to afford maximum hand marking flexibility and economy.

TYPE HOLDERS

Precision made for easy type changes, long life and available for press and for hand marking.

STEEL TYPE

All sizes are specifically designed to produce a legible and lasting impression on every marking application.

Custom MARKING DIES AND STAMPS.... by Parker

STEEL HAND STAMPS

Simple, speedy handstamps for permanent marking of tools, products, assemblies.

ROLL MARKING DIES

Ideal for precision marking graduations, lettering, trademarks, patent numbers and combinations on flat, curved and irregular surfaces.

HOT STAMPING DIES

Hardened tool steel dies with uniform, lapped faces to cleanly stamp gold leaf or colored foil impressions on numerous materials with exacting neatness and accuracy.

Investigate the flexibility of Parker's facilities

Send today for Parker's illustrated 36-page catalog and the name of the Parker representative in your area.

THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

Lightweight Aluminum Stages for Painting or Maintenance Work

Complete line of all-aluminum stages is available with deep-truss construction for greater rigidity. Manufacturer states the 30-ft model will support a 500-lb weight in the center with very little deflection. Decking is of extruded aluminum strips with raised dimples, skid-proof even when greasy or wet.

Available in a complete range of sizes from 8 to 30 ft in standard widths, 12, 20, 24, 28 in. to fit standard stirrups.

R D Werner Co, 295 Fifth Ave, New York 16, NY

Protects Surface From Ultra-Violet Light

Violite protects surface coatings against deteriorating effects of ultra-violet light and ozone. Material is also reported to have excellent resistance to excessive humidity or salt-laden atmospheric conditions.

It is transparent and contains certain ingredients which reduce the attack of ultra-violet light to material or painted surface to which it is applied. Coating is applied approximately 0.001 in. thick as final coat over painted surfaces, vinyls, or other type coatings.

Booker-Cooper, Inc, 6940 Farmdale Ave, North Hollywood, Calif

Precision Timer for Short Intervals

Model 432 interval timer measures short-time intervals. Three ranges are provided: 0.01 to 9.99 msec, 0.1 to 99.9, and 1 to 999 msec. Instrument also serves as totalizing counter with count capacity of 999. Control of start and stop for time-interval measurements may be achieved by any of the following: positive pulse, negative pulse, contact closure, contact opening, or any combination. Counters may be reset at end of each interval measurement or allowed to accumulate number of intervals for averaging.

Potter Instrument Co, Inc, 15 Cutter Mill Road, Great Neck, NY

Pressure-sensitive and dry-adhesive coatings of various strengths can now be applied to both sides of sponge rubber. This reportedly greatly reduces labor cost in the adherence of sponge rubber parts on the production line. Product is available in all thicknesses up to 1 in. and comes in strip or die-cut form.

Durable Rubber Products Co, 549 W Fulton St, Chicago 6, Ill

The Geargrind Universal Oscillating Grinder will perform a wide range of grinding operations. Its initial cost is much lower than would be expected for a grinder with so many specialized uses.

Now...For toolroom or production work —a really versatile and rugged universal grinder

The Geargrind Universal Oscillating Grinder for Fine Finishing of Spherical–Conical –Cylindrical Surfaces

Whether you need tool room accuracy or production economy, you'll save time and money with the versatile Geargrind Universal Oscillating Grinder.

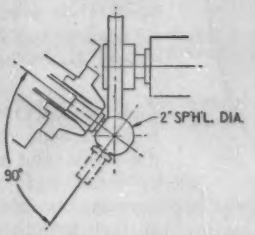
With its various simplified attachments, it is designed to perform *all* of these precision grinding jobs:

- internal and external cylindrical surfaces
- generated or formed spherical internal and external surfaces
- external conical surfaces
- internal tapers
- ball bearing races and fillets

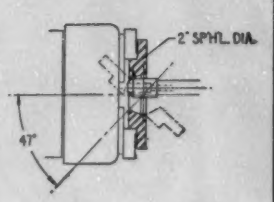
YOU'LL WANT ALL THE FACTS

We have prepared a comprehensive 6-page catalog on all the information and specifications of this unique grinder. Please write—we'll be happy to send it to you, along with a quotation of Geargrind's new low prices.

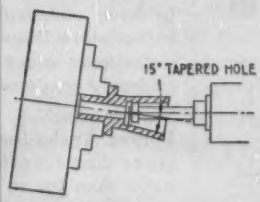
Typical examples of work performed on the Geargrind Universal Precision Grinder



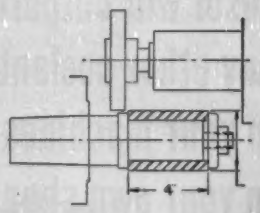
Ball stud, alloy steel, carburized and hardened. Held in a collet.



Flanged ball socket, cast iron. Held in a diaphragm chuck.



Grinding wheel adapter. Grinding the tapered hole. Held in a precision 4-jaw chuck.



External cylindrical grinding.

GEARGRIND Detroit

THE GEAR GRINDING MACHINE CO.
3919 Christopher
Detroit 11, Michigan

WE'LL BET YOU A STETSON

Lusol will outperform any other coolant in your machines in your own shop

Read about this

Abrasive Material Is Non-Clogging

Sand Screen is a non-clogging open-mesh abrasive material for sanding operations where loading is a problem. Reported to have been extensively field tested in sanding of ferrous and non-ferrous metals, abrasive is coated on both sides with silicon carbide grain. Open-mesh construction is said to reduce loading to minimum.

Sand Screen can be used wet or dry for both machine and hand sanding operations. It comes in full sheets, cut sheets, and disks, in grit sizes of 180 and finer. It can be used flat or folded to any desired size.

The Carborundum Co, Niagara Falls, NY

Two mechanical rod packings have been developed using a new lubricant and impregnation process for handling non-water soluble solvents. Style No. 181 has a square braided rayon base, and is recommended for pumps, valves, and fittings, handling such chemicals at temperatures up to 200 F. For temperatures above 200 F, Style No. 1024 is recommended, which has a high-grade, braid-over-braid white asbestos base.

Flexrock Co, Packing Div, 3600-A-Filbert St, Philadelphia 1, Pa

Line of seat rings, precision made from carbon, stainless, or tungsten die steels, and hard faced at points of wear and impact with stellite overlays, is said to provide a wear surface that increases load carrying capacity and operating life. Available in 1 to 14-in.-dia sizes, furnished to meet specified tolerances. Depth of hard-facing alloy is determined by size of ring, and will vary from 0.060 to 0.090. Overlay is said to have excellent wear, heat, and corrosion-resistant characteristics.

Cleveland Hard Facing, Inc, 3047 Stillson Ave, Cleveland, Ohio

Parker Turbo-Sweep floor sweeper sucks dust from the air at a rate of more than 300 cu ft per min; heavy-duty fiber brushes collect debris in a hopper. Removal and emptying of hopper is a 10-sec operation; dust-collecting bag, 1.6 cu ft, eliminates frequent emptying. Unit is equipped with a gasoline engine and a Maxim silencer. The 28-in. sweeping width permits cleaning of more than 30,000 sq ft of floor area per hour under normal conditions. Available in 40-in. width.

Parker Sweeper Co, 100 Bechtle Ave, Springfield, Ohio

Hayden drill dispenser, with glass cover, is useful as an inventory container to hold all popular sizes of fraction drills compactly arranged together. Drill gage plate is furnished as part of each unit for use when tools are returned to stock with markings on shanks obliterated by chuck jaws. Pockets fit not only standard jobber lengths, but also the newer machinist length drills.

Hayden Twist Drill Co, 7626 Lyndon, Detroit 38, Mich

Neofloor is an easily applied skid-proof surface coating for concrete, wood, and metal floors for use where oils, greases, and chemicals create safety hazards and maintenance problems. Grit-like material is anchored in a matrix of resilient neoprene and bonded firmly to the floor with an adhesive primer. Both primer and coating are supplied in liquid form for easy, quick-drying application with brush or roller. Waterproof material is easily cleaned with commercial detergents and cleaners.

Corrosion Engineering Products Dept, Pennsylvania Salt Mfg Co, Philadelphia 7, Pa

Regulators, designated 8900 Series, supersedes Air Reduction's 8600 Series; designed for use with gases supplied by pipeline systems using comparatively low pressures. These oxygen cutting and welding regulators afford greater flow capacities in most cases than the former series with improved regulation and lower static increment. Regardless of fluctuation in line pressure, regulators are said to accurately maintain a steady gas pressure, eliminating need for frequent regulator adjustment. They are of inverse-type design and have a seating arrangement requiring no nozzle. Details in Catalog ADC 705.

Air Reduction Sales Co, 60 East 42nd St, New York 17, NY

Extra-translucent and durable contact paper has been designed to give faster print-back speeds when diazo or blueprint reproductions are made. Kodagraph Contact Paper Translucent is reportedly tough and durable and will withstand considerable handling and use. Photographic lines can be removed with an ordinary erasure after paper is moistened slightly. Paper's emulsion produces dense black photographic lines which are clean, sharp, and legible. Available in all standard Kodagraph contact paper sizes.

Eastman Kodak Co, Rochester 4, NY

BECAUSE Lusol IS DIFFERENT . . .

WE DARE SUGGEST A SHOP-WIDE TEST!

Prove Lusol—not in just a single machine—but in a lathe, boring mill, grinder, milling machine and drill

THE DIFFERENCE—Unlike ordinary coolants, Lusol is an oil-free, all-chemical concentrate to which you add water to suit the machining operation. Water, the best coolant known, is made wetter so that it gets to the tool point and carries off heat faster. With Lusol there is no rusting, no skin irritation, no smoking to foul shop atmospheres.

YOUR BENEFITS—Superior heat dissipation means that your present equipment can be worked harder, yet your men find things easier—higher speeds and feeds, with less downtime for sharpening tools, finer finishes and closer tolerances. Improved working conditions result in better morale among your employees.

These benefits become shop-wide as your workmen recognize Lusol's advantages and ask for it in their machines.

THE CHALLENGE—Prove to your own satisfaction—in your own plant, in your own machines—that Lusol will do all we say for it. If it doesn't, you get a Stetson. Our field engineers will help you clean out the machines marked for the test and install Lusol in proper concentrations. Frankly, judging by past experience in hundreds of metal working machines, we don't expect to lose a hat.

TO GET THIS TEST WORKING, MAIL THIS COUPON

We'll have a Lusol field engineer call and arrange to run the test in your own plant.

F. E. ANDERSON OIL CO., INC.
PORTLAND, CONNECTICUT

F. E. Anderson Oil Co., Inc., Box 215, Portland, Connecticut

Have your man call to discuss arrangements for installing Lusol All-Chemical Coolant in the machines selected for this test.

Name_____ Title_____

Company_____

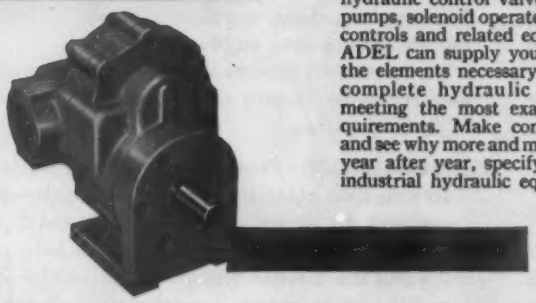
Address_____

Send me the booklet, "Lusol Gets to the Point"

ADEL

A COMPLETE LINE OF INDUSTRIAL HYDRAULIC EQUIPMENT FOR EVERY APPLICATION

For fourteen years ADEL has continuously directed its energies to the advanced development and production of high-quality hydraulic equipment. With the most modern facilities in our 150,000 square foot plant, we build ruggedness, efficiency and compactness into each ADEL unit. The variety of equipment being manufactured has been steadily expanded until today it encompasses a complete line of hydraulic control valves, power pumps, solenoid operated remote controls and related equipment. ADEL can supply you with all the elements necessary to build complete hydraulic systems meeting the most exacting requirements. Make comparisons and see why more and more users, year after year, specify ADEL industrial hydraulic equipment.



A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF HYDRAULIC EQUIPMENT. INQUIRIES INVITED.

Write for Bulletins
ADEL DIVISION
OF GENERAL METALS
CORPORATION,
10767 Van Owen St.,
Burbank, California

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL
PORATION · Burbank, Calif.

Manufacturers of Industrial Hydraulic Valves and Pumps

DISTRIBUTORS: AIR & HYDRAULIC CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND, OREGON • J. BOYD COATES, PHILADELPHIA, PA. • FRANK T. DONNELLY COMPANY, PITTSBURGH, PA. HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO, CALIF. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE, CALIF. • HYDRAUUC BRAKE SUPPLY CO., PHOENIX, ARIZ. • LINCOLN SUPPLY CO., PROVIDENCE, R. I. • SCOTT EQUIPMENT AND ENGINEERING COMPANY, DAYTON, OHIO • H. F. SODERLING CO., SEATTLE, WASH. • ROBERT TAYLOR & SONS, SALT LAKE CITY, UTAH • WYATT SALES COMPANY, CLEVELAND, OHIO • CORBY SUPPLY COMPANY, ST LOUIS, MO. • INDUSTRIAL AIR & HYDRAULIC EQUIPMENT CO., DETROIT, MICH.

Raco bar hanger is adjustable through telescoping action of the two halves of the hanger; operates like an adjustable curtain rod. Clip, which secures box to the bar without interfering with device space in the box, also provides added wiring room in multiple-device units. Clip and stud bars fit all sizes of furring and studdings from 1 x 2 in. to 2 x 4 in., and all sizes of joists and rafters, as well as shallow-wall construction.

Raco Div, All-Steel Equipment Inc, Aurora, Ill

Chemi-Spot metal identification kit utilizes well-known spot-testing techniques for testing over 80 of the commonly used metals and alloys appearing on the market. Unit weighs 12 lb, is contained in a portable carrying case and comes equipped with all necessary chemicals except concentrated acids which must be supplied by purchaser. Included is a booklet, "Rapid Identification (Spot Testing) of Some Metals and Alloys" published by International Nickel Co.

Westcott Laboratories, Elizabethtown, NY

Utility cart to speed work of handling and assembling small parts is made of 1-in. seamless steel tubing. Unit carries four lightweight tote boxes made of plastic. These are waterproof, stainproof, acid, alkali, and oil-resistant. Said to be suitable for many assembly-line jobs, are reportedly unbreakable, non-splintering, self-stacking, and self-nesting. Each box weighs 4.1 lb; is 18 x 12 x 8 in. inside; holds one cubic foot. Cart is designed to hold boxes so they remove easily but cannot slip or slide.

Laboratory Construction Co, 1115 Holmes St, Kansas City, Mo

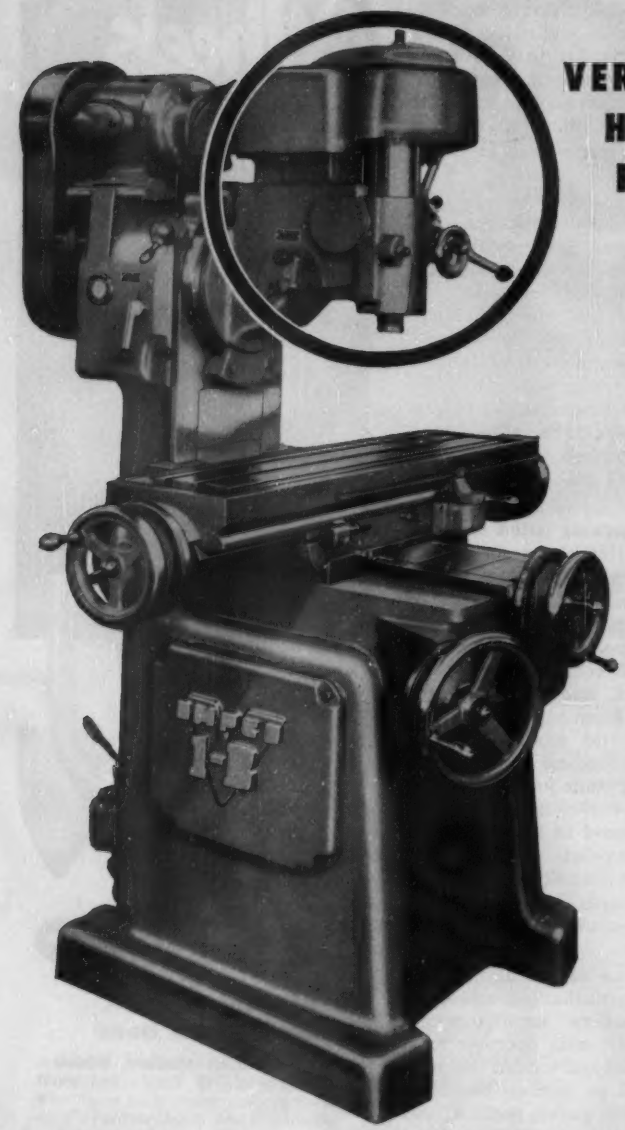
Method for bonding of rubber to a nylon bearing, developed by Minnesota Rubber and Gasket Co, is said to save up to 50% reduction in total cost of finished parts. In this process the injection molding and bonding within close tolerances are done in one operation.

Minnesota Rubber & Gasket Co, Dept KP, 3630 Wooddale Ave, Minneapolis

Model 245 ⅜-in., 45° Harbot connector for attaching armored cable to knockout boxes in electrical installations can be installed from outside of the box after wiring hook-up is completed. Especially recommended for installations where vibrations exist; reportedly, they will not vibrate loose.

Unimatic Corp, 52 East Centre St, Nutley, NJ

Here's a NEW design feature in Vertical Mills!



VERTICALLY ADJUSTED HEAD GIVES GREATER RIGIDITY AND ACCURACY

Here are the facts . . .

Unlike knee-type mills, the head of the IMPCo Model 1-B Vertical Milling Machine is vertically adjusted by a counter-balanced ram. The table and controls do NOT move vertically. The exclusive ram design has greater rigidity. Its larger scraped bearing surface area gives more accuracy for both production and tool room milling.

Massive Design for *Versatility* and *Precision*

The IMPCo Model 1-B is heavy for a No. 1 Mill. It weighs approximately 3,100 lbs. Spindle quill diameter is 3½". Uses *standard* 1 HP motor.

Get all the facts.
Write for Bulletin AM-102.

IMPCO

INDUSTRIAL METAL PRODUCTS CORPORATION

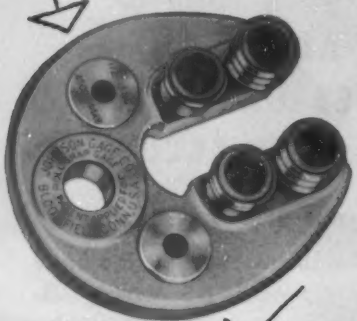
Builders of IMPCo Straighteners, the American HEB Pilot Lathe, and Special Machinery

3400 W. ST. JOSEPH STREET **LANSING, MICHIGAN**

JOHNSON'S

new

ROLL-Snap THREAD Gage



Model RR

for the utmost in

- ECONOMY
- FLEXIBILITY
- SPEED
- SIMPLICITY

Here is the finest designed ROLL-Snap Gage on today's market. Its huskier, simplified construction actually *lowers* its production cost which means lower prices to you.

Incorporates such exclusive features as precision ground working surfaces on frame . . . all frames, rolls and studs interchangeable . . . Go rolls have restricted end play to detect "drunken" threads . . . Not Go rolls, cone and vee type, correct for Pitch Diameter check . . . lapped steel washers to assure permanent alignment and rigidity of studs. Roll-guards optional.

Where more exacting control and information is required, Johnson RING-Snap thread gages or ROLL-Snap and RING-Snap Comparators, Analyzers, and Standard Accessories are recommended.

NEW illustrated literature explaining how to get maximum thread control at lowest costs is yours for the asking.

(Specify Form C-RR-54)

Johnson Gage

THE JOHNSON GAGE COMPANY

BLOOMFIELD, CONNECTICUT

No. 8 non-corrosive flux for use on copper, brass, terne plate, tinplate, is non-ionizable even under high conditions of humidity, eliminating both electrical leakage and corrosion. Product is a rosin and alcohol flux fortified to suspend surface oxide on common metals more rapidly and thoroughly without charing or building excess residue, and still leaves a neutral rosin residue that does not set up a corrosive attack. Tests have shown No. 8 is fast enough to solder on clean steel without pretinning.

Farrelloy Co, 1217 N 26th St, Philadelphia 21, Pa

Ten complete control packages, individually designed for specific furnace, oven, kiln, or dryer applications, are available for automatic control of any heating application. Packages include all components necessary for complete installations, as well as all sensing elements, electric and air-operated control valves, combustion safeguards, panels, and accessories. Details in Bulletin P1260.

The Bristol Co, Waterbury 20, Conn

Lightweight stacking pallet for handling of cylindrical shapes that stand on end has formed strap legs. Angle iron is used in the frame construction and extends up from feet to form side supports 28 in. high with horizontal and vertical intersecting cross members. Ends are open for easy loading from either side and hinged cross-arms which drop out of the way for loading can be raised and hooked on studs joining the side supports and enclosing load. Hardwood floor is used in the pallet and access is provided for lift-truck handling from four sides.

Equipment Manufacturing, 21550 Hoover Rd, Detroit 5, Mich

Multichek is an electrical multiple gaging instrument that inspects seven critical dimensions simultaneously on a shell body, with operator having only to load and unload the part. Part is placed on loading platform, slid forward into gaging position, and the master light on the diagram panel reveals whether or not all dimensions are within tolerance limits.

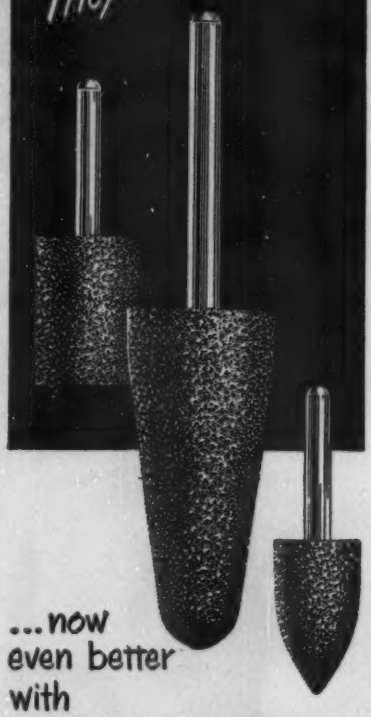
Sheffield Corp, Dayton 1, Ohio

Portable outlet box is wired complete with three outlets, one hot, 2 controlled by toggle switches, rated 10 amps at 125 v ac-dc. Red signal light illuminates when plugged in. The 18-gage steel case is supported on 4 rubber feet. Price, $8.30.

The Fostoria Pressed Steel Corp, Fostoria, Ohio

Chicago MOUNTED Wheels

They're the Best



...now even better with

79E BOND

the new miracle grinding wheel bond

Choose Chicago Mounted Wheels — bonded with 79E Bond — and you'll never buy any other! This tough new grinding wheel bond, exclusive with Chicago Wheel, has taken the industrial world virtually by storm, doing a better grinding, burring and finishing job faster. Greatest selection of sizes and shapes for every application. Best of all, deliveries are good . . . ready when you need them. Try 79E Bond Mounted Wheels.

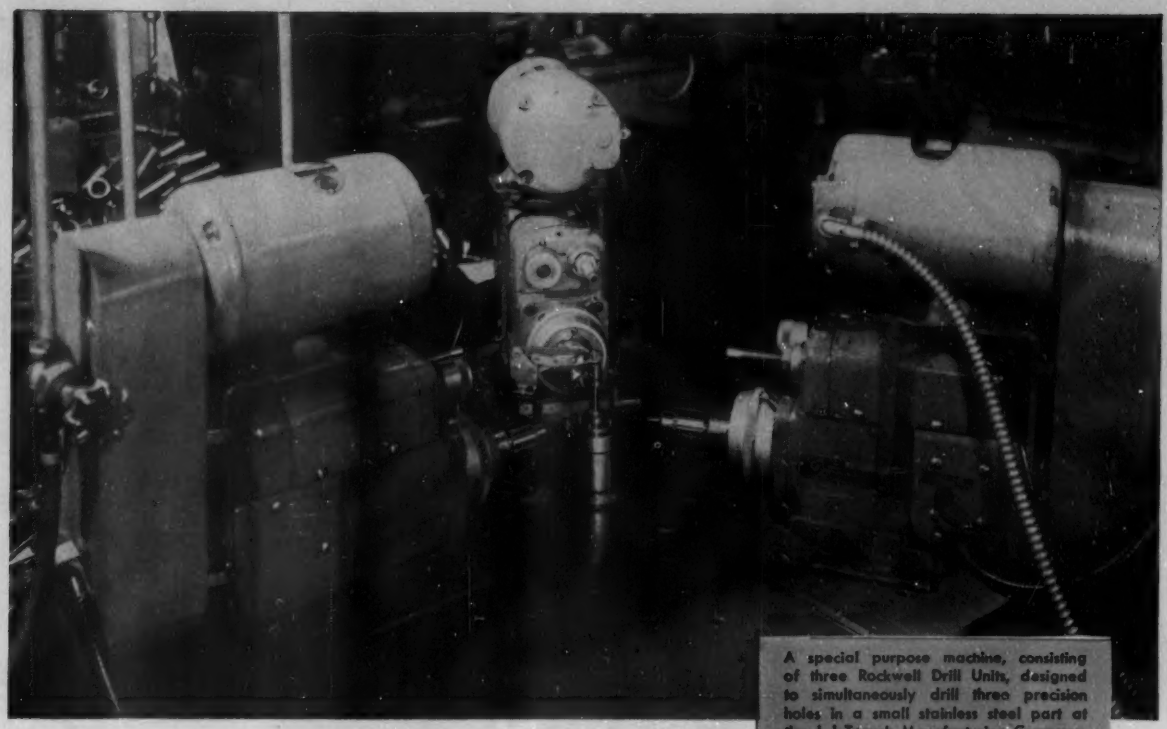
WRITE today for full information and literature. It's free.

CHICAGO WHEEL & Mfg. Co.

Dept. A.M. • 1101 West Monroe Street

Chicago 7, Illinois

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS



A special purpose machine, consisting of three Rockwell Drill Units, designed to simultaneously drill three precision holes in a small stainless steel part at the J. J. Tourek Manufacturing Company. The operation cuts parts cost 43%. Precision Rockwell Drill Units reduce time and motion in countless machining and assembly operations—can be mounted in any tooling arrangement.

J. J. Tourek Manufacturing Company
CUT PER PART COSTS 43%
with Rockwell* Air-Hydraulic Drill Units!

When production requirements at J. J. Tourek Manufacturing Co., Chicago, demanded a machine to drill small parts much faster than the single drill method, design engineer Donald Moeller developed a simple machine around Rockwell Air-Hydraulic Drill Units. It achieved the needed production and cut per part cost by 43% on the complete size range of stainless steel parts.

Says Mr. Moeller, "In the one year we've had our Rockwell Drill Units in two-shift production, their fast, reliable performance has exceeded our expectations. They've sped up production terrifically, reduced our costs and greatly increased drill life. Maintenance costs are so low we don't bother to record them."

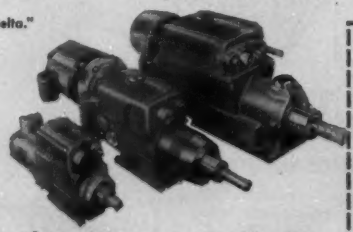
The Rockwell Drill Unit is a hydraulically controlled, precision packaged power unit that provides positive automatic control of length of rapid approach, feed, and depth. Singly or in multiples, it can be electrically interlocked with other units or mechanisms, and can be operated by unskilled personnel with a minimum of training. The Rockwell Drill Unit has proven time and time again that it can save big money in drilling, tapping, counter-boring, and kindred operations. *It can do it for you.*

Let your Authorized Sales Engineer discuss possibilities with you. He not only offers you engineering counsel, but can also demonstrate right in your plant. Send the coupon today for his name.

*Originally produced by Rockwell under the trade name "Delta."

Air-Hydraulic **DRILL UNITS**

Another Product by **Rockwell**



15 Drive Arrangements—from ⅓ to 5 hp.

Drill Unit Division, Rockwell Manufacturing Company
618F North Lexington Avenue, Pittsburgh, Penna.

☐ Please send name of nearest Authorized Sales Engineer.

☐ Please send me latest Drill Unit Catalog.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____

★ ENGINE
★ REMOVABLE BLOCK GAP
★ EXTENSION BED GAP

NEBEL LATHES ARE FAST, TOO

. . . and they play a big part in the jet engine and other programs where production requirements are high

Nebel
LATHES
CINCINNATI

"I don't care if they are our most important asset. You can't fill this safe with your MOLITE High Speed form tools."

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

Buckeye portable air-powered nibbler for cutting sheet metal up to 18 gage is available in a new model with an extended head which permits use in confined areas and in formed metal panels. Tool, capable of cutting a radius as small as 1 in., can be used to follow any contour. Available with lever or lock button throttle, nibblers have hardened and ground anvil and punch, both easily accessible for regrinding.

Buckeye Tools Corp, Div 9, PO Box 966, Dayton 1, Ohio

All-State No. 35 FC aluminum rod, flux coated, for both carbon arc and torch welding, is designed specifically for work on aluminum types 3S, 14S, 43S, 52S, 53S, and 61S. Advantages claimed are increased speed of application without sacrifice of physical properties, sound, porosity-free welds, and less distortion of work. Diameters are 3/32, 1/8, 5/32, and 3/16 in.; length, all sizes, is 28 in.

All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY

All-plastic Saf-I-Spectacle has a dual-purpose acetate frame to permit instant change from regular to side shield model. Non-flammable, non-sparking shields screw into place for jobs requiring side protection. Lightweight spectacles are fitted with plastic Optilite lenses, said to last ten times as long as hardened glass on jobs where they are exposed to pitting from sparks and hot metal splashes.

US Safety Service Co, Kansas City 6, Mo

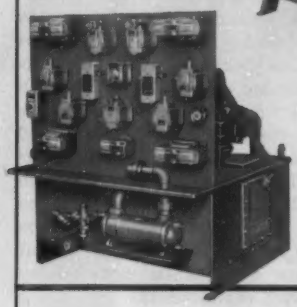
Low-cost automatic clutch has been designed for use on gasoline engines from 3 to 10 hp, with 1-in. and 1⅛-in.-dia shaft extensions, and on electric motors from 2 to 5 hp, 1750 rpm. The 600 series can be installed without altering present shaft extensions, provides load-free starting and idling for engines. Said to reduce starting current demand and to offer overload protection for electric motors.

Salsbury Corp, 1161 East Florence Ave, Los Angeles, Calif

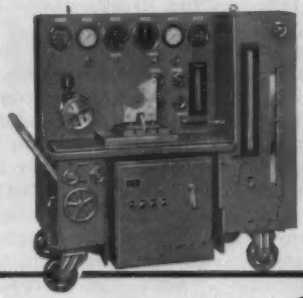
Fluorocarbon plastics in a sample kit are available including specimen shapes of both Teflon and Rulon, (special bearing material). Contents consist of at least four inches of Rulon rod, a machined piece of Rulon extruded Teflon rod, and Teflon tubing, small Teflon molded and machined samples, and Teflon spaghetti tubing. Price $10.

Dixon Corp, Bristol, RI

Pulpit type power unit provides full visibility, easy accessibility.

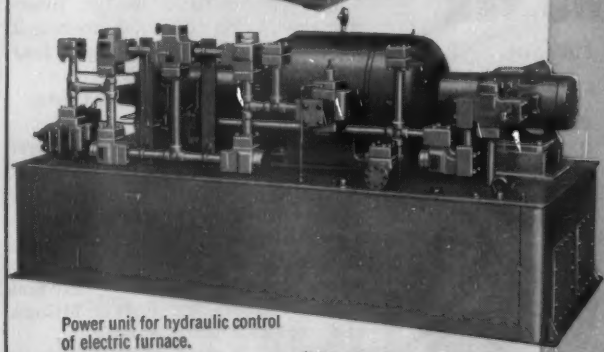


Compact power unit showing gasket-mounted valves.



Portable power unit for testing pumps.

Power unit with gasoline engine as prime mover.



Power unit for hydraulic control of electric furnace.

6837

Individually Designed to Meet *SPECIFIC* Needs

VICKERS®
Custom Built
HYDRAULIC POWER UNITS

DEPENDABLE PERFORMANCE

IMPROVE AND SIMPLIFY DESIGN

REDUCE INSTALLATION COST AND TIME

EASIER SERVICING

BETTER APPEARANCE

Vickers engineers approach the design of a custom-built hydraulic power unit from the standpoint of the customer's INDIVIDUAL needs. The sole objective is to meet HIS requirements with the best hydraulic "package". This assures the most compact, efficient and convenient hydraulic equipment for the particular machine.

A Vickers Hydraulic Power Unit includes all necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc., as well as all hydraulic accessories (oil filters, air cleaners, oil level gauges, fittings, etc.). Hydraulic connections can be grouped in a convenient manifold.

In addition to the advantages mentioned above, each Unit is pretested at the factory and ready for immediate operation. Vickers undivided responsibility for the entire hydraulic control system is also an important feature to both the machine builder and his customer. Write for Bulletin 52-45.

VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Smooth operation:

WELD GRINDING with

NU-TEX DEPRESSED CENTER WHEELS

Undercutting and reducing heavy welds is a smoother, faster, safer operation when you use Nu-Tex Depressed Center Disk Wheels. *Smoother* because Nu-Tex Wheels are designed with a built-in resiliency to reduce bouncing to a minimum, assure a steady, cushion-like grinding action. *Faster* because their cushioned cutting action distributes pressure evenly over grinding areas . . . makes every inch of surface travel an inch of productive cutting, whether you use portable or bench-type grinders. *Safer* because they're bonded together with an extremely tough resin for maximum durability . . . textile-reinforced to assure greater protection against breakage, longer life under continuous operation.

Why don't you investigate the time and money-saving advantages of Nu-Tex Disk Wheels? Straight and depressed center Nu-Tex Wheels are available in all popular diameters and thicknesses for cutting, slotting, roughing, smoothing, grinding or polishing. Grades range from 0 (hard) to 6 (soft). Write now for complete details. Atlantic Abrasive Corp., 516 Pearl St., South Braintree 85, Massachusetts.

Specify **NU-TEX** *for 360° of wheel efficiency!*

ATLANTIC ABRASIVE CORP.

South Braintree 85, Massachusetts

No. 1000-6 retaining rings are available stacked on metal rods for fast easy assembly for use on 1/16-in.-dia shafts. Rod is part of dispenser unit which includes especially designed cast iron base and application tool, supplied with each initial order. Rings are carbon spring steel, beryllium copper, phosphor bronze.

Industrial Retaining Ring Co, Mt. Vernon, NY

Moisture-proof high-voltage insulation has been developed for use in internal wiring of electronic instruments; the thermoplastic material is recommended for use where high humidity conditions prevail. For identification, product comes in 10 base colors; where tracers are required, insulation is white with two identically colored helical stripes to indicate base color and a third stripe to show tracer color. Input circuit wiring is solid white covered by color-coded rayon braid.

Minneapolis - Honeywell Regulator Co, Industrial Div, Philadelphia 44, Pa

Zero-Mist, a surface active agent, has been developed to prevent air and airborne contamination from chromic acid spray and mist in chromium-plating bath operations. Said to be completely stable and virtually indestructible, additive is unaffected by concentrated chromic acid solutions at any temperature or by the highest anode or cathode current densities obtainable. It is also said to reduce film drag-out up to 50% through ability to lower surface tension of plating solution to an unusual degree, making possible a total saving up to 70% of chromic acid.

Udylite Corp, 1653 E Grand Blvd, Detroit 11, Mich

Air gage for inspecting jet engine airfoil strip stock for thickness, width, and camber at a rate of 300 fpm has been introduced by Sheffield. Instrument is 33 in. wide, 31 in. deep, and has a 12-column Precisionaire at eye-level height. Interchangeable and adjustable tooling is provided to permit checking of four different widths of stock.

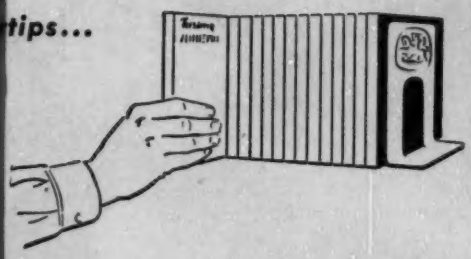
The Sheffield Corp, Dayton 1, Ohio

Lub-Oil package for jet-engine test cells pumps oil into engine holding it at constant temperature and pressure as in operating conditions. Equipment includes aid-operated valves, 20 gpm Yale & Towne pump, Cuno filter, heat exchanger load cell and precision indicators, Parker fittings, and explosion-proof motor.

J N Fauver Co, 51 West Hancock, Detroit 1, Mich

Have Technical Knowledge at Your Fingertips...

Send for REYNOLDS READY-REFERENCE HANDBOOK LIBRARY



These valuable handbooks belong on the desk of every engineer, designer and production man. Single copies of any or all of them are free when requested on business letterhead. Otherwise each book is one dollar.

A Complete Index of all Reynolds Technical Literature and Films on aluminum design and fabrication is also available. **Write Reynolds Metals Company, 2523 South Third Street, Louisville 1, Ky.**

16 MM Color-Sound Films Available, Too

1. SHAPE OF THINGS TO COME (extrusions)
2. TALE OF THE POWDERED PIG (powders and pastes)
3. PIGS AND PROGRESS (mine to finished product)

Instructors in technical schools are also invited to take advantage of these educational aids. Write for details.

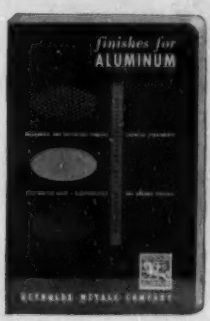
ALUMINUM DATA BOOK—156 tables give complete physical, chemical and mechanical properties; availability data, tolerances, definitions, fabrication information . . . 194 pages.

ALUMINUM POWDERS AND PASTES—Describes types of powders and their uses in paints and coatings, pyrotechnics, processing, metallurgy and other applications . . . 84 pages.

DESIGNING WITH ALUMINUM EXTRUSIONS—Explains the basic principles for using extruded aluminum shapes most effectively . . . 138 pages.

ALUMINUM STRUCTURAL DESIGN—Shows how to design original structures with aluminum or convert present designs to aluminum . . . 130 pages.

FASTENING METHODS FOR ALUMINUM—Offers information on mechanical joining and fastening methods, and the advantages of each . . . 136 pages.



FINISHES FOR ALUMINUM—Gives basic data on application and uses for electroplated, mechanical, chemical and organic finishes . . . 124 pages.

ALUMINUM FORMING—Presents accepted practices for bending, forming, and drawing aluminum . . . 152 pages.

MACHINING ALUMINUM ALLOYS—Covers aluminum machining including automatic screw machining . . . 124 pages.

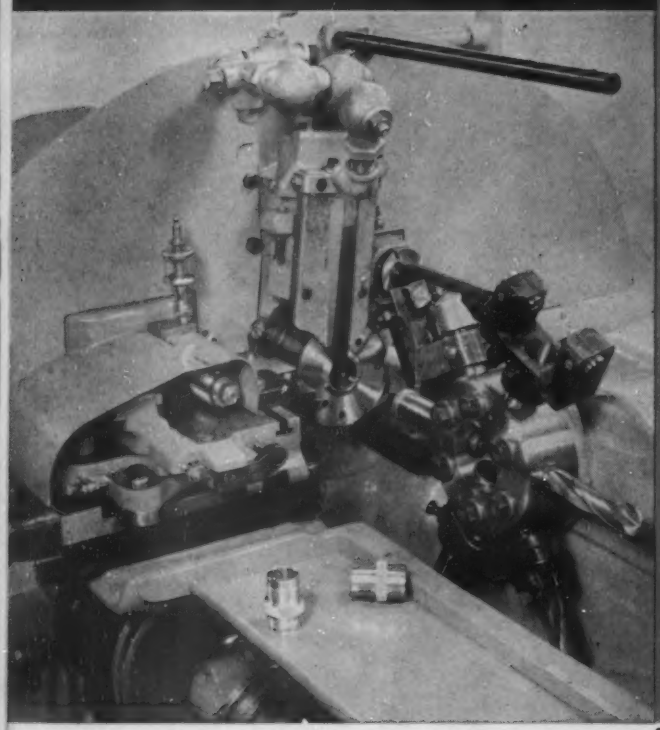
HEAT TREATING ALUMINUM ALLOYS—Explains the theory and procedures for heat treating aluminum alloys . . . 119 pages.

WELDING ALUMINUM—Gives complete data on the welding, brazing and soldering of aluminum . . . 186 pages.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND - More Information on Next Page

Up Goes Output...



Down Go Costs

when you use

REYNOLDS ALUMINUM SCREW MACHINE STOCK

Aluminum alloys are excellent for screw machine work because, job for job, they machine at greater speeds and feeds—with standard tools, or with slight modifications for the higher speeds. That means a *step up* in production, and it's easy to see how your unit costs for material, handling and shipping *step down* with strong, lightweight aluminum that gives you three times the number of pieces per pound. Rust-free aluminum often requires no finishing but, when needed, takes most of the regular metal finishes . . . also permits a wide choice of attractive anodized finishes in natural tones and sparkling colors.

For prompt delivery on aluminum screw machine stock plus design and fabrication engineering service when you need it, call your nearby Reynolds Office or distributor listed under "Aluminum" in your classified telephone directory. They'll also show you how you can increase your sales and save your customers money if you submit alternate quotations based on aluminum when other materials are specified. For more complete information write on business letterhead for your free copy of the 124 page handbook, "Machining Aluminum Alloys," and index of Reynolds Literature. Reynolds Metals Company. 2523 South Third Street, Louisville 1, Kentucky.

SCREW MACHINE ALLOYS

11S-T3—Free machining. Fine finishes at high speed. Free cutting, fine chips, good strength. Excellent for screw machine work. Longer tool life but slightly less strength than 17S-T4. Good formability of machined parts.

17S-T4—Excellent finishes. Fine for general purpose machining. Good corrosion resistance and strength.

SPECIAL MACHINING ALLOYS

24S-T4—For simple machine work. Chips long and curled. Stronger than preceding alloys. Smooth finishes.

61S-T6—Good corrosion resistance, weldability, strength. Lower machinability. Best formability and suited to electro-chemical finishes.

2S and 52S—Higher purity aluminum alloys available for special applications. Have good formability.

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND — More Information on Preceding Page

MSA Comfo chemical cartridge respirator has been developed to protect wearer against toxic dust as well as organic vapors. Static-web dust filters clamp on respirator's twin chemical cartridge filters; dust filter is made of charged, resin-treated felt which promotes electrostatic retention of dust and supplements mechanical filtering action. Cartridges and filters are independently replaceable. Further details in Bulletin 1007-4.

Mine Safety Appliances Co, Braddock, Thomas & Meade Sts, Pittsburgh 8, Pa

Caster-Steer trailer, 4000-lb capacity, for overhead tow systems has standard hardwood deck 3 x 6 ft in dimensions and is fitted with stake pockets at both sides and rear for standard removable pipe racks. Permanent angle-iron rack at lead end is used to mount a V-type tow chain and hook assembly, fitted with shock absorber springs, and a push bar handle for man-handling the trailer. Deck size and construction can be altered to meet special requirements.

Mercury Mfg Co, 4044 S Halsted St, Chicago 9, Ill

Arrow-Hart control centers consist of a number of combination motor starters each housed in a separate compartment which is, in turn, part of a dead-front, factory-framed panel section ready for installation. Any number of sections may be used or added as needed. Units, because of right-angle design of starters, are said to require far less space than conventional types. Electrical and constructional details described in Bulletin 170.

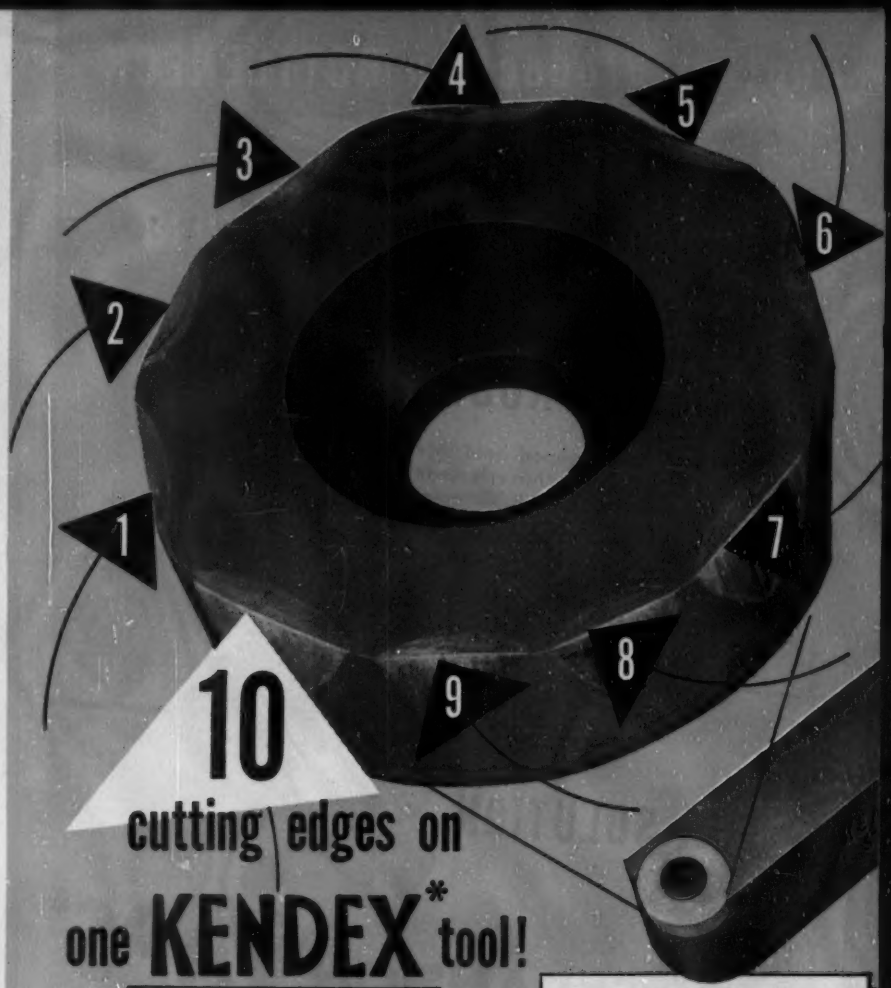
Arrow-Hart & Hegeman Electric Co, Industrial Control Div, 103 Hawthorn St, Hartford 6, Conn

Kwikfluxer No. 54 for silver brazing and hard soldering is available in a Kwikfluxer applicator container made of plastic with screw cap tip, and refillable. It is only necessary to pierce tip, squeeze, and apply to work. Dispenser holds 12 oz of product ready for use, requires no diluting for most applications.

Special Chemicals Corp, 100 S Water St, Ossining, NY

Multiple drill-head attachment for production drilling in metal, wood or plastic features infinite number of adjustments on 3 standard ¼-in. chucks within 3 to 5½-in. diameters. Each of three spindles has ¼-in. Jacobs chuck, 2 annular-shielded ball-bearing mountings, and is driven by ⅜-in. pitch roller chain.

Silver-King Corp, Aurora, Ill



No tool grinding expense and *minimum* machine down time for tool changing—these are the advantages you obtain from multiple-edge Kendex "throw-away" insert tools. For example:

A Kendex round insert, used to bore 2½" cast iron stators, machined 300 pieces before one cutting edge dulled. Then, without removing the shank from the boring bar, the "button" was revolved to a new cutting position, until 3,000 stators were machined with the insert's 10 cutting edges. Best previous performance, by a conventional brazed tool, was 400 stators per tool grind.

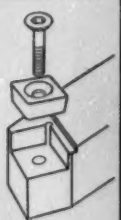
Kendex precision-ground buttons have Kennametal's high wear-resistance, for long life. Screw-mounted, they can be rotated in seconds to new cutting positions without removing or resetting the tool holder . . . a great time-saving feature. When all cutting edges are used, the insert is thrown away—replacement cost is slight compared to that of regrinding.

Only Kennametal makes Kendex "throw-away" inserts. Ask your nearest Kennametal tool representative to help you apply this cost-saving tooling to suitable operations in your plant. Kennametal Inc., Latrobe, Pa.

*Registered Trade-Marks

How KENDEX* Works

1 Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.



2 Kendex inserts are mounted to suitable tool holders with socket head screws.

3 When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.

KENNAMETAL*
CEMENTED CARBIDE TOOLING
THAT INCREASES PRODUCTIVITY

A-8 SALES OFFICES IN PRINCIPAL CITIES

Another Production BOTTLENECK

SOLVED BY PRATT & WHITNEY

THE PROBLEM

To keep tapped hole thread pitch diameters within tolerance when materials, wall thicknesses and thread lengths varied from lot to lot.

THE SOLUTION

PW EXPANSION TAPS*

This AN Connector manufacturer was faced with the problem of accurately maintaining thread pitch diameter tolerances. Each thread size required taps of varying pitch diameter due to product and set-up variations. Tool costs and tool inventories were high. So, the Pratt & Whitney Cutting Tool Representative, a factory-trained specialist, was asked for recommendations. The use of Pratt & Whitney Expansion Taps for this application solved the problem . . . one tap for each thread size, expansible for proper control of product pitch diameter.

THE RESULT (1) Lower initial tap cost; (2) reduced tap inventory; (3) increased production per grind; (4) longer tap life; (5) improved quality.

Pratt & Whitney can help you solve your tough production problems. The Pratt & Whitney Representative . . . and the entire facilities of our organization . . . are at your service. Just phone your nearest Pratt & Whitney Branch Office or write direct to West Hartford.

*Not suitable for applications involving heavy chip loads per tooth.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.
SINCE 1860

First Choice PW for Accuracy

MACHINE TOOLS • CUTTING TOOLS • GAGES

Model 400 Huot Tuldex, a tool chest for vertical storage, is said to provide double capacity. Six 12x18-in. tool-holding panels, made of perforated hardboard, along with two doors, provide more than 24 sq ft of storage area. Drawer is included for power tools. Panels move on individual tracks on geared, self-lubricating bearings. Cabinet may be placed on a bench, hung on wall, or mounted atop a portable Huot Porta-Cab. Overall size is 29 x 20 x 13¾ in.

Huot Mfg. Co., 530 N Wheeler St, St Paul 4, Minn

Non-plasticized polyvinyl chloride sheet, designated Type 1 and Type 3, is available in various thicknesses measuring 9 x 4 ft. These heat-weldable products are supplied in standard thicknesses ranging from ten thousandths of an inch to 2 in. Type 1, optimum chemical resistant sheet, is supplied in black color under trade name Ampcoflex; Type 3, optimum impact sheet, supplied in gray color under trade name Pee Vee Cee. Welding rod for fabrication of structures is available.

Atlas Mineral Products, Mertztown, Pa

Tug-Bar material-moving equipment is available in a 24-v, dc model. The 110-lb device moves loads in excess of two tons, and can be operated wherever there is room for one man to stand. Unit is composed of a reduction gear, powered by either ac or dc motor, mounted on wide driving wheels. Operating controls are brought out to the adjustable handle attached to unit.

Western Gear Works, PO Box 182, Lynwood, Los Angeles County, Calif

V5-3 valve has a quick exhaust feature said to increase operating speed of small air and hydraulic cylinders by more than doubling the speed of cylinder return stroke. The ⅛-in.-dia orifice is controlled by utilization of pressure differentials. Almost all V5-3 three-way normally closed valves can be equipped with this built-in device. Specifications in Bulletin 530.

Skinner Electric Valve Div, Skinner Chuck Co, Edgewood Ave, New Britain, Conn

Nylok self-locking threaded inserts for use principally in non-ferrous forgings, castings, and extrusions, have been designed to eliminate counter-boring and special tapping, and require no special tools for insertion or removal. Said to eliminate

thread failure by absorbing stresses and to prevent thread wear and stripping. Provide smooth, positive locking torque on both internal and external threads.

The Nylok Corp, Elmira Heights, NY

Chromekill 4A chromate reducer for alkaline cleaning and plating solutions provides dual action. Contains materials for fast reduction of hexavalent chromium to the harmless trivalent chromium state, as well as more stable reducing agents to give prolonged production. Product is available as a fine free-flowing powdered mixture and is used in concentrations of the order of ¼ oz-gal.

Enthone, Inc, Dept AM, 442 Elm St, New Haven, Conn

Automatic pen-lifting device has been designed for single-record strip chart recorders. Special rod and lever attachment can raise pen either during "off" periods to prevent ink blots; during periods of either chart changing, or when chart is torn off recorder; or when the measured variable falls below any selected value. Pen lifter can be used either with conventional or ball-point pens and can be installed on instruments with either one or both left- and right-hand operation pens.

Minneapolis-Honeywell Regulator Co, Industrial Div, 4494 Wayne Ave, Philadelphia 44, Pa

Medium-duty casters have been introduced with a shock-absorbing floating-hub design to provide load and floor protection. Units, recommended for safely removing liquid and fragile solid loads of from 100 to 700 lb, are readily interchangeable with standard conventional medium-duty casters. Series 09 and 10 are available with 5½ and 7-in.-dia wheels in either swivel or rigid design, with rubber or semi-steel tread wheels in 2-in. thread widths.

The Bassick Co, Bridgeport, Conn

Shim stock of laminated aluminum in which laminations are bonded over entire surface, is said to peel for adjustment in the same way as brass and steel shims. Material makes available all the advantages of aluminum—light weight, freedom from corrosion and electrolytic action—in shims that peel quickly and smoothly for adjustment. Available either custom-stamped to blueprint specifications or as laminated sheet stock in thickness from 0.015 to 0.125 in., sizes to 20x48 in.

Laminated Shim Co, Inc, Glenbrook, Conn

PRATT & WHITNEY

CHUCKING REAMERS

BLUE HELIX or STRAIGHT FLUTE

with straight or taper shank

SMOOTHER CUTTING, MORE ACCURATE, LAST LONGER

because...

DISTINCTIVE P&W SPECIAL SURFACE TREATMENT . . . a special additional surface-hardening process gives far greater resistance to chip abrasion. Reamers cut longer, stay accurate longer.

SUPERIOR ACCURACY . . . Cutting Diameter, Shank Diameter and Chamfer are all accurately finished on the same centers and meet rigidly high P&W standards for both size and concentricity.

CORRECT DESIGN . . . Flutes provide proper rake and ample chip clearance. Controlled cylindrical margin and back taper assure more accurate holes. Proper chamfer and chamfer relief assure smooth, free chip formation.

AVAILABLE . . . from stock in all standard diameters. In addition, a wide range of special diameters can also be supplied promptly, finished to order from hardened in-stock blanks.

SEND NOW FOR COMPLETE INFORMATION . . . Use the coupon below.

First Choice for Accuracy

PRATT & WHITNEY

DIVISION NILES-BEMENT-POND COMPANY

11 Charter Oak Blvd., West Hartford 1, Conn.

Please send my free copies of

☐ *Circular No. 563, Blue-Helix Reamers;*

☐ *Circular No. 571, Straight Flute Reamers.*

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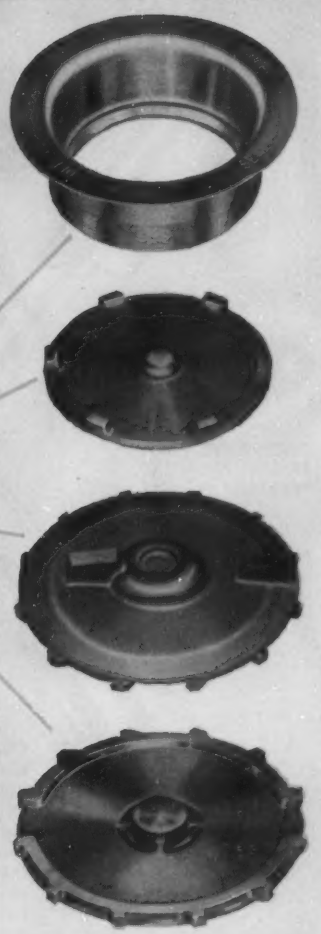
MACHINE TOOLS • CUTTING TOOLS • GAGES

MUELLER BRASS CO. forgings* contribute to the efficiency of this modern waste disposal unit

***MUELLER BRASS CO. facilities include: designing, die-making, forging, tooling, machining, polishing, plating and assembly**



Three Mueller Brass Co. forgings play an important part in the fine operating performance of this modern waste disposal unit made by the Eureka-Williams Co., Division of the Henney Motor Co., Inc. This unit does a speedy and thoroughly effective job of pulverizing garbage and has made life easier for American housewives. The impeller disposer that chops up the waste food in the disposal unit, the disposer cover and the sink mounting flange are all forged by the Mueller Brass Co. This is another outstanding instance where Mueller Brass Co. forgings have improved product performance and cut costs. High quality forgings can be produced from standard and special brass, bronze and aluminum alloys. And in addition, the Mueller Brass Co. offers complete service ranging from product design to finished part . . . Write today for complete information and new 32 page forgings handbook.

1. Sink mounting flange, forged, machined, nickel and chrome plated by Mueller Brass Co.
2. Machined and finished disposer cover forging.
3. Cutting side of impeller disposer forged from 600 series bearing bronze.
4. Reverse side of impeller disposer.

MUELLER BRASS CO.

PORT HURON 23, MICHIGAN

EV Series explosion-proof lighting fixture with prismatic Holophane reflector is designed for use in locations where there is possibility of flammable gases being present. When equipped with an "inside frosted" 5000 lumens, 300-w lamp, it delivers a total light efficiency of 72.3%. Heat and impact-resisting lamp globe is held firmly in place by a rigid clamp ring.

Crouse-Hinds Co, North St, Syracuse, NY

Seamless plastic welding helmet incorporates G-E standard ventilation design for cooler welding and prevention of lens fogging. Designed to fit contour of any head; wider range adjustment is provided by ratchet device; four-position stop meets vertical and overhead needs. Available with or without a flip-front, weighing 29 and 25 oz respectively.

General Electric Co, Welding Dept, Schenectady 5, NY

Microstrip, a close-tolerance grade of beryllium copper strip, is available for a wide range of critical applications. Available thicknesses run from 0.001 to 0.032 in., with minimum tolerances ranging from ± 0.0001 to ± 0.0004 in. depending upon thickness. On widths from 3/32 to 5 in., tolerances of ± 0.001 and ± 0.002 are regularly held.

Penn Precision Products, Inc, 501 Crescent Ave, Reading, Pa

Red traffic light system, installed at Standard Pressed Steel, flashes a warning whenever an overhead crane approaches any one of three heavily traveled cross-aisles. Photoelectric eyes are connected to blinker warning lights, suspended over each intersection at a height of 12 ft. Plant-made device cost company less than $250 per aisle.

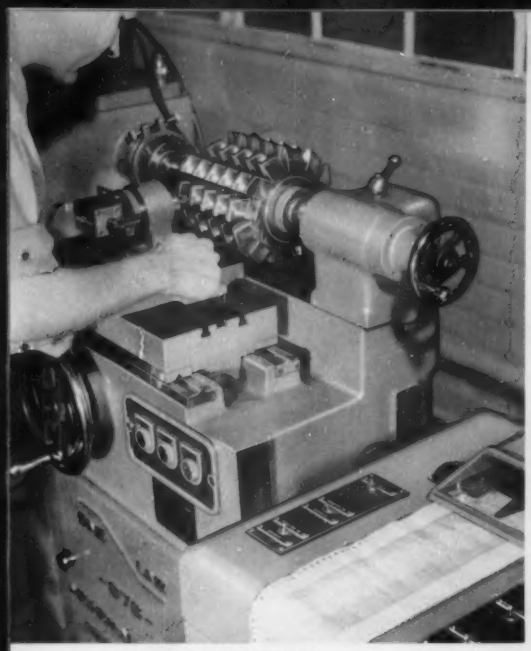
Standard Pressed Steel Co, Jenkintown, Pa

Fig. 1152, hand truck has been improved in the glides to provide easier, safer, and better balanced traversal up and down curbs or stairs. They permit smooth slide in a position approximately parallel to slope of curbs or stairs. Constructed of electrically welded tubular steel with choice of single or double handles, and open or solid plate noses in 5, 7, or 9-in. lengths. Frame size: 14 x 48 in. high with choice of 6 or 10-in. roller bearing, semi-pneumatic, rubber-tired wheels for outside as well as inside use.

Nutting Truck & Caster Co, 1125 W Division St, Faribault, Minn

This Month's

GEAR PIX



ACCURACY – Accuracy of the gear is directly related to the accuracy of the hob that generates the teeth of the gear. A Michigan Tool inspector is shown here checking and charting the accuracy of a large two-thread Michigan Process hob on the Michigan Sine-Line model 874 hob lead checker.

15 SHEAR-SPEEDS – Four of a battery of fifteen Michigan Shear-Speed gear shapers which cut a variety of slots or serrations on malleable planetary elements in a large automotive automatic transmission plant. All slots or serrations are cut simultaneously, in some cases two parts at a time, by the Shear-Speed gear shapers.

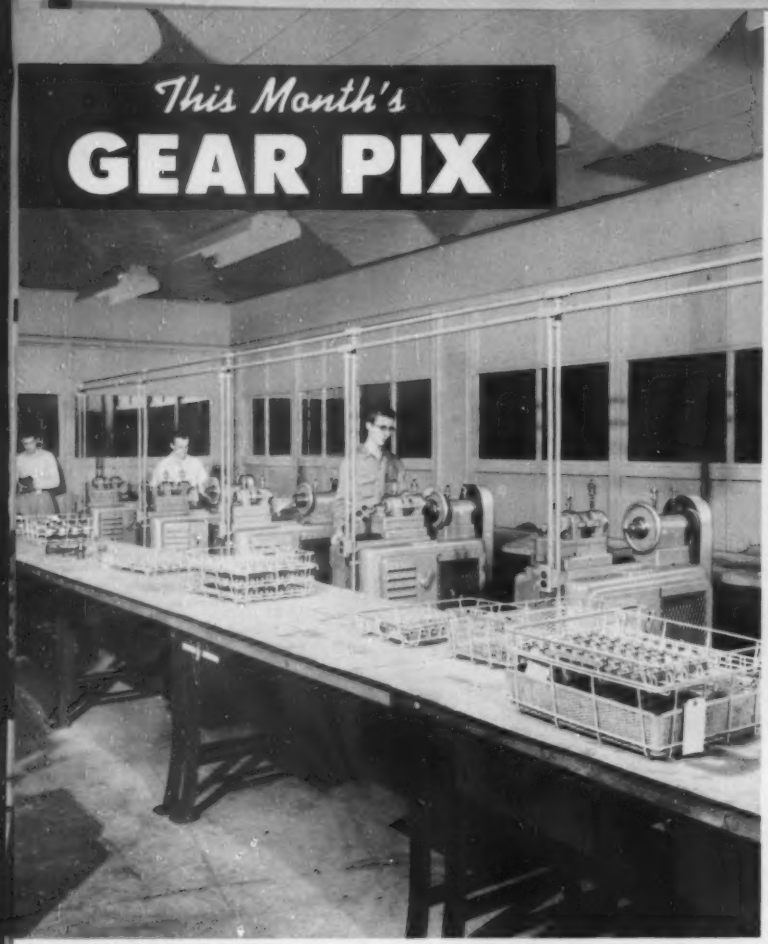
***NEW* 3-WAY GEAR SELECTOR** automatically segregates 100% of gear production into undersize, oversize and OK gears as fast as they are cut or finished. Made in both gravity and conveyor types. May be attached to any gear cutting or gear finishing machine. Can be integrated with the machine cycle to automatically shut off the machine whenever a certain percentage of undersize or oversize gears are produced.

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.
IN CANADA: COLONIAL TOOL CO. LTD.

Over

This Month's

GEAR PIX



GEAR INSPECTION—One of the rows of Michigan model 1129 gear speeders used to inspect gears in a large automotive automatic transmission plant, prior to assembly. Gears are speeded in mesh under brake loads to check quietness and tooth contact.

INVOLUTE AND TOOTH SPACING—One of the leading lathe manufacturers uses this Michigan Sine-Line model 1124 involute and tooth spacing checker to inspect the involute contours and tooth spacing on the helical and spur gears that are used in their line of lathes.

AUTOMATIC LOADING & SIZING

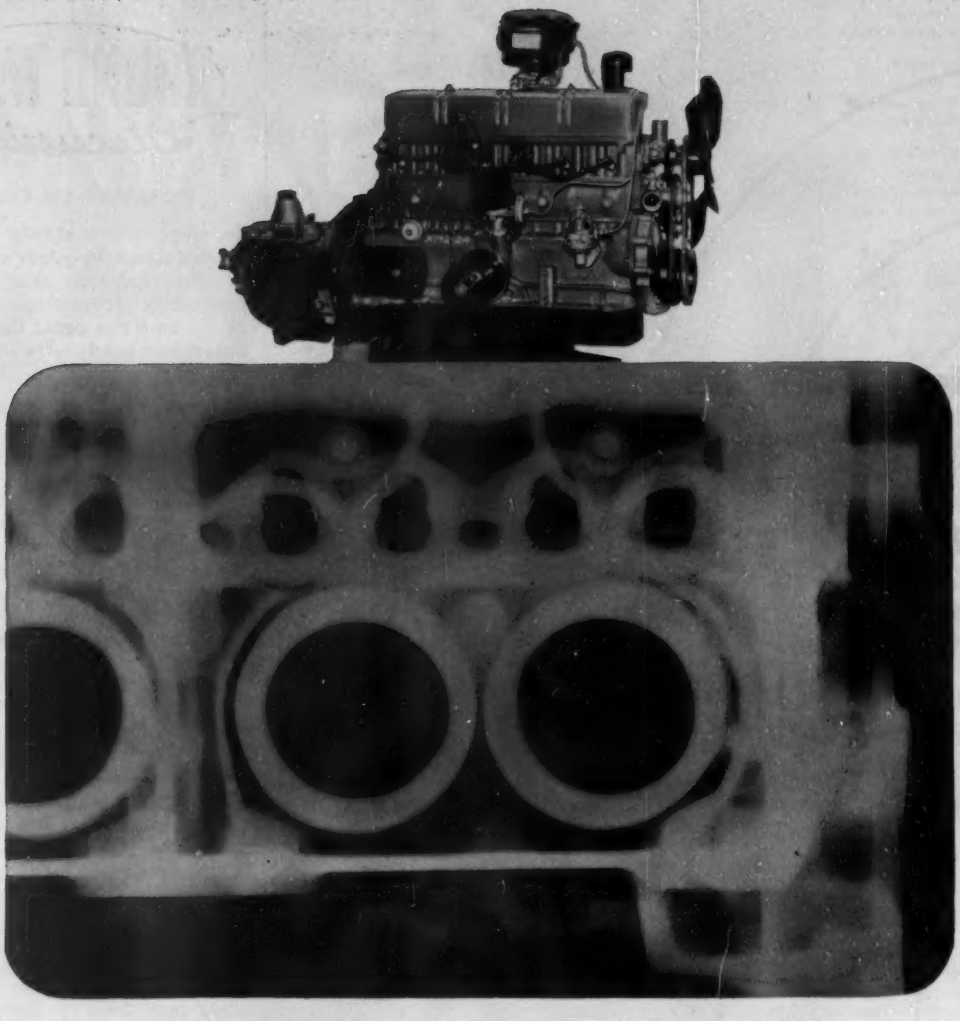
More than four out of five of the standard Michigan 870 gear shavers now being built are equipped with automatic chute loading and automatic size checking. This speeds up the shaving cycle and permits one operator to handle up to three of these machines with ease.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.

Over



Production line "bugs" get X-RAYED out on the pilot model

MASS production of car engines calls for a continuous run of castings as uniformly sound as it's possible to pour. No sand holes. No gas holes. No core shifts.

Manufacturers take care of that early in their plans. They radiograph pilot castings—can spot thin walls, "out-of-rounds," and other irregularities which a change in casting procedure can forestall.

Improving yield is one of the reasons more and more foundries are making radiography routine. It is the one way to be sure only high-quality work is released.

Radiography can improve your plant operation. How? Your x-ray dealer will tell you. Or, we'll send you a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division, Rochester 4, N. Y.

Radiography...

another important example of Photography at Work

Kodak

wider and wider use

PEARLITIC MALLEABLE CASTINGS

as engineers become aware of its many advantages

DESIGN ADAPTABILITY: Because of its good fluidity, it can be cast in thin sections and in complicated shapes.

HIGHER STRENGTH: Ultimate strengths range between 60,000 and 90,000 psi; yield strength between 40,000 and 70,000 psi.

EASILY MACHINED: Machinability index (B1112 Steel=100) ranges between 60 and 90.

WEAR RESISTANCE: Withstands excessive wear under heavy loads at high speeds.

LOCALIZED HARDENING: Sections of the casting can be flame hardened or induction hardened before or after machining.

BEARING PROPERTIES: Good non-seizing properties in metal-to-metal contact.

FINE FINISH: Can be given a very smooth finish where desired.

You will find many applications for Pearlitic Malleable castings – particularly as a replacement for forgings, stampings and weldments – where reduced weight, less machining time, fewer assembly operations and better appearance are important production and sales considerations.

A-2254

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

ROUND TABLE Discussion

FOREMAN OR CLERK?

To what extent should a foreman be tied down by paper work? Does so-called red tape slow up normal production overseeing, or will it in the long run avoid duplication of orders and lost time in emergencies?

HOW MUCH RED TAPE can a production department stand? The answer is enough—enough to do its job, fill its quota, keep the following departments busy, or whatever is necessary.

I worked with, under, and through the Taylor System which was the real beginning of modern scientific management. Today, the name of Fred Taylor is almost forgotten; few men know about his years of study in the field of the art and science of cutting metals. A still smaller number of us remember that Fred Taylor is responsible for the modern functionalization of labor in industry.

The oldtime machine shop foreman was a walking filing case. He carried pencils, pen, a notebook, a pad of requisition blanks, a pad of hiring and a pad of firing blanks, as well as blueprints, a folding rule, a steel scale and a plug of chewing tobacco. (It's true there were a few Mail Bag and Red Man loose tobacco devotees, but the large majority of shop men favored Horseshoe Plug Cut. It was a satisfactory chew.)

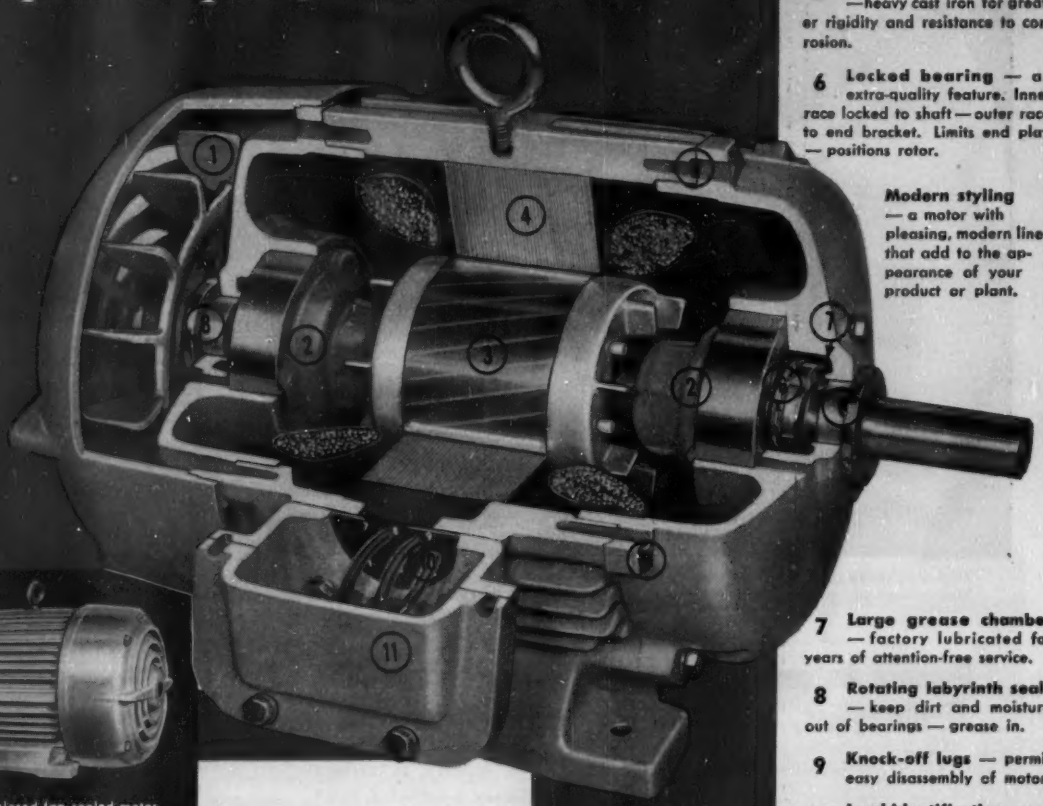
The foreman dished out the work, hired his own men, chased his own material, kept his own time cards, disciplined his men, inspected and

"Don't run off tonight, Bill. I want you to work a little overtime."

Here's the inside story of

the NEW L.A. *Line*

...your BEST enclosed and explosion-proof motor BUY



1 Fan — efficient, non-sparking fan. New aerodynamic design for more effective cooling.

2 Inner bearing cartridges — lock bearings to end bracket and form explosion-quenching seal along shaft.

3 Indestructible cast-aluminum rotor—dynamically balanced with fan for smooth, quiet operation.

4 Stator — prewound stator core utilizes Formvar wire insulated with a new Alkyd Asphalt Resin insulating varnish.

5 End bracket and housing —heavy cast iron for greater rigidity and resistance to corrosion.

6 Locked bearing — an extra-quality feature. Inner race locked to shaft — outer race to end bracket. Limits end play — positions rotor.

Modern styling — a motor with pleasing, modern lines that add to the appearance of your product or plant.

7 Large grease chamber — factory lubricated for years of attention-free service.

8 Rotating labyrinth seals — keep dirt and moisture out of bearings — grease in.

9 Knock-off lugs — permit easy disassembly of motor.

10 Lead identification—permanent, positive lead identification spacer in conduit box.

11 New split conduit box — rugged cast-iron conduit box diagonally split for easy connection.

Totally enclosed fan-cooled motor

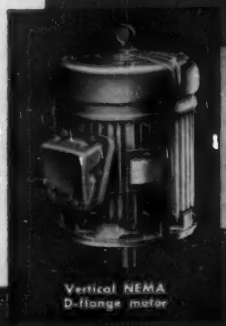
Cutaway view of explosion-proof motor

This is the completely new L.A. totally enclosed fan-cooled and explosion-proof motor. Every feature in this new line is designed for easier installation, longer service life, less maintenance and attention. You get the full benefit of the new NEMA standards in a smaller, more functional, completely modern design.

Your nearby Louis Allis Sales Engineer can show you all the reasons why these motors perform better and longer on your tough jobs — why they give you maximum resistance to corrosion wherever you need this extra protection. Call him today.

THE LOUIS ALLIS CO.
MILWAUKEE 7, WISCONSIN

LA-103



Vertical NEMA D-flange motor

NEMA C-flange motor

NEMA D-flange motor

We specialize in SPECIAL MOTORS— *and* PROMPT DELIVERY, TOO

58 semi-automatic setups with ONE BASIC UNIT

Alternately opposed Drill Heads — with a work locating jig — mounted on a movable bracket. With two pieces loaded, each Drill Head produces a half hole cavity in each piece. Thus, in each 12-second cycle, 24 cavities or 12 holes are produced.

Dumore Automatic Drill Heads put carbide drilling of fibreglass, aluminum — on a production basis

THIS job involved drilling 12 cavities (1/16" radius), at various spacings from 1-3/8" up in each of 35 different lengths of 3/8" fibreglass rod. It required a drill head with spindle speeds high enough to use a carbide drill for the highly abrasive fibreglass. Mass production seemed out of the question.

However, with a relatively simple unit (see photo caption)—consisting of 12 Dumore Automatic Drill Heads with spindle speeds of 7500 rpm — this manufacturer *is* mass producing. In 2000 hours he produces 10,000,000 cavities . . . and what's more . . . by merely changing jigs, he gets 23 additional setups to drill various sizes of aluminum tubing!

Here's just one of many cases in which the exceptional adaptability of Dumore Precision Tools provides a simple solution . . . at relatively little cost . . . to otherwise extremely difficult problems. If you want to know where and how Dumores can help you, contact your Industrial Distributor or write:

®

DUMORE PRECISION TOOLS

The Dumore Company

1337 Seventeenth Street • Racine, Wisconsin

passed his own work, put jobs out to the foundry, the boiler shop, or the pattern shop and did it verbally with the occasional aid of a rough sketch. I might add that the foreman also functioned as his own repair boss or construction boss.

The better grade of shops gave their foremen a timekeeper who also did some material chasing. It remained for Fred W Taylor to plan a scientific division of labor and to separate the foreman's functions into the individual elements of planning, scheduling, time keeping, repairing, working, disciplining, inspecting. Gradually the foreman was unloaded of his extra duties, and the modern science of functional management came into being.

I would suggest he do it. This word-of-mouth business is no good. Most of us have burned our fingers at one time or another over verbal orders. I remember sending a four-inch shaft to the shop at one time—and a hot job too—and verbally requesting over the telephone that it be turned down to three and nine-sixteenths OD. I had the foreman repeat my instructions and then write it down.

That shaft came back turned down to three and five-sixteenth inches in diameter. I learned then that five sounds like nine when heard over the telephone — to some people it does.

Now, of course, it would be nice and it would be preferable if there were a planning department to write the order, make the sketch, figure the tolerances, plan the move, send a truck to deliver and pick up the material, and provide an inspector to check the finished product back in. As apparently these folks are lacking, it behooves Ed to roll up

"I think you'd better cut off a teentsie-weentsie bit more."

forged spindles are now turned

200% faster

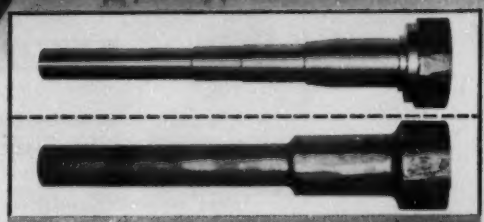
with the new Axelson Trace-o-Matic Hydraulic Tracer Attachment

The Trace-o-Matic attachment provides fast, automatic precision duplication from flat templates and is adaptable to all classes of work including contour turning, boring and facing. It takes full advantage of the ability of Axelson lathes to take heavy uninterrupted roughing cuts or fine finishing cuts to very close tolerances without the need of a highly skilled operator.

Many outstanding features are designed into the Trace-o-Matic which make it exceptionally economical to own and to operate. Only simple, inexpensive flat soft steel templates which serve for both roughing and finishing are required. Templates can be readily made in your own shop by turning in a bar holder or any other method. In addition, only simple single point tools are required and expensive form tools are completely eliminated. Set-ups require only minutes and after the machine is set to turn the first work diameter it is automatically set to produce all diameters and contours from the template. Small lots or large quantity production work can be handled with equal efficiency and economy.

Your turning costs can be greatly reduced and your production increased by installing a Trace-o-Matic on your present Axelson lathe or by ordering it on a new Axelson lathe. It will pay you to look into the matter without delay!

Write for Axelson's 16-page bulletin describing the New Axelson Trace-o-Matic attachment in detail, or call your nearby Axelson distributor. 6158 Boyle Street, Los Angeles 58, California



PERFORMANCE DATA

Part	MACHINE SPINDLE
Machine	Axelson 20" lathe with Trace-o-Matic attachment
Number of Pieces	6
Material	4820 Steel Forging
Hardness	180 Brinnell
Max. Depth of Cut	¾"
Greatest Precision	+.003"—.000"
Tool Material	Tungsten Carbide
Floor to Floor Time	64 Min. with Trace-o-Matic
Floor to Floor Time	129 Min. Former Method
Production Increase	200%

AXELSON MANUFACTURING COMPANY DIVISION

PRESSED STEEL CAR COMPANY, INC.

LOS ANGELES 58, CALIFORNIA

PSC

RAILROAD FREIGHT CARS • STANDARD PARTS • DAIRY & FARM EQUIPMENT • WASTE CONTAINERS • STAINLESS STEEL COOKWARE • CAR ACCESSORIES • TANKS • AGITATORS • SMOKE STACKS • DUST COLLECTORS • COAL & ASH HOPPERS • FITTINGS & ELECTRICAL ACCESSORIES • INSURANCE MATERIAL • WINCHESTER RELOCATABLE HOMES • EXPORT ONLY: LOCOMOTIVES & TRACKWORK • CARS (MINE, ORE, CANE, INSPECTION) • UNISTRUT METAL FRAMING • WEED BURNERS • BRICK & TILE MACHINERY • CANE SUGAR

MALCOMIZING

FOR SURFACE HARDENING STAINLESS STEELS

CALL *LINDBERG STEEL TREATING CO.*

It'll pay you to investigate Malcomizing if you use surface hardened stainless steel parts in your finished product. Malcomizing imparts increased wear resistance, increased abrasion resistance, increased corrosion resistance and increased erosion resistance to stainless steels.

Hundreds of manufacturers from coast to coast have found that Malcomizing means improved results . . . longer product life . . . better performance . . . finer finished products.

- Malcomizing increased hot press die runs from 100% to 300%!
- Malcomizing improved wearing quality of wire guides . . . 10 to 1!
- Malcomizing eliminated damaging erosion and corrosion of air pump piston and connecting rods!
- Malcomizing resisted moisture condensation and eliminated rust that formerly caused failure on aerial camera valves!
- Malcomizing increased wear resistance of governor valves and valve seats for steam turbines!
- Malcomizing improved the corrosion resistance of movie projector parts subject to adverse climatic conditions!

Get your copy of the Malcomizing booklet. It discusses types of steels that can be Malcomized . . . suggested heat treatments before Malcomizing . . . selective Malcomizing . . . case depths . . . stability at elevated temperatures . . . corrosion resistance . . . and the passivation of Malcomized steels.

For the complete story of this product-improving, money-saving process, ask for your copy of the new 28 page booklet, "Malcomizing".

Plants in

MELROSE PARK
1983 N. Ruby
Fillmore 4-4080

ROCHESTER
620 Buffalo Rd.
GEnessee 5212

ST. LOUIS
650 E. Taylor
Fireside 6200

LOS ANGELES
2910 So. Sunol Drive
ANgelus 9-7311

LINDBERG STEEL TREATING CO.

1983 North Ruby Street, Melrose Park, Illinois Phone: FIllmore 4-4080

his sleeves and do those things himself. If he reaches the point where he is overloaded with that type of work, the Lord will provide relief. He generally does in some form or other.

James K Matter
Detroit, Mich

TO A GREAT NUMBER of people, any amount of paper work is looked upon as just so much red tape which takes up too much of a man's valuable time. In days of old a foreman had about two forms with which to conduct his business: an order blank for stock, and another, the famous yellow slip. After getting an order, accompanied by the necessary drawings, he'd proceed to make out his requests for stock, then dump the whole thing on the workman's bench and say "Hop to it." Invariably the keeper of the stock would pay a visit to the foreman and inform him that he didn't possess a certain kind of steel and then he would substitute something else at the foreman's request. Often the stockman wouldn't take the time to consult the foreman and would substitute something that he thought would answer the purpose. If all went well, nothing further was said, but if difficulties arose, which often happened in heat-treatment, then all hell would break loose which afforded the foreman good exercise from his monotonous existence.

The most delightful form of red tape was the yellow slip. The old-timer took particular deight in filling out one of these things and would do so usually in a hurried way, then slip it to the offender with the usual accompaniment: "Here, get the hell out and don't come back." The yellow slip seems to have gone the way of the dodo — I haven't had one

"OK, men! Get in there and give 'em all you got!"

Bay State Taps produce threads of the utmost precision with a maximum of productivity. This dual quality of Bay State Taps ... *precision performance* ... is readily available from nearby shelves of industrial supply distributors.

BAY STATE TAPS

BAY STATE TAP & DIE COMPANY | MANSFIELD, MASS.

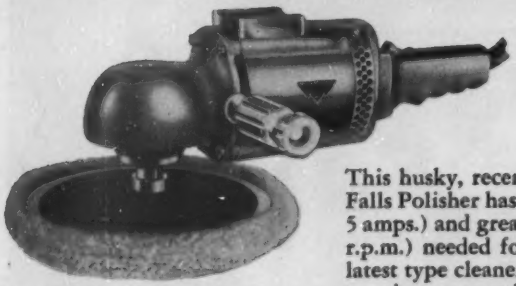
FOR

New, light-weight, heavy-duty No. 404

MILLERS FALLS GRINDERS

Latest addition to Millers Falls famous line of portable electric grinders, the No. 404 weighs only 9¼ lbs., yet has a 5.5 amp. rating. It uses 4" diameter wheels up to 1" wide and is designed for continuous heavy-duty service such as snagging castings, grinding welds, grinding off rivets, etc. Other models up to 6" with speed ranges from 3700 r.p.m. to 5500 r.p.m.

FASTER



High-speed, high-powered No. 270

MILLERS FALLS POLISHERS

This husky, recently-introduced Millers Falls Polisher has the extra power (a full 5 amps.) and greater spindle speed (1900 r.p.m.) needed for best results with the latest type cleaners and polishes that are proving so popular. It's light, compact, pleasant to use — and it's supplied with a deep, carpet-pile wool pad, the most effective polishing head ever developed.

FINISHING

MILLERS FALLS SANDERS

A beautifully engineered 7" unit, the 870 weighs only 7½ lbs., but carries a full 5.5 amp. rating and can handle continuous operation. Its no-load speed of 4500 r.p.m. makes it perfect for driving the new laminated phenolic grinding wheels and discs as well as for fast sanding. Other models available up to 9".

Light, high-power No. 870

MILLERS FALLS TOOLS SINCE 1868

The Mark of Superiority

FREE — Write for literature on Millers Falls wide line of portable electric grinders, polishers, sanders, drills, saws, screw drivers and other high-performance tools. Demonstrations gladly arranged on request.

MILLERS FALLS COMPANY, Dept. AM-2, Greenfield, Mass.

slipped to me for over forty years! One has to commit murder nowadays in order to get fired from a job and when he does get his skids greased he has to pass through a good-sized tree of forms made out in triplicate —one pink, for the foreman's record; a blue one to go to the paymaster; and the yellow one to personnel.

Verbal messages, or instructions, are the direct opposite of red tape. They are not worth the paper they should be written on. No matter how sincere and straight-shooting a man is, his word counts for nothing so far as effective business procedure is concerned. I don't mean by this that he isn't to be trusted; it is that verbal messages are mostly evanescent to a certain degree and are not to be depended upon for effectiveness over a reasonable period of time.

Basically, a foreman is the head of a department; he leads his men to perform their work in the most efficient manner. Modern business requires that he do a certain amount of clerical work as he cannot do his job without it. This paper work should be kept to the minimum so that the supervisor's time will not be unnecessarily encroached upon. Too many forms to fill out deprives him of many valuable minutes that he could put to better use in supervision.

Modern business necessitates that it be conducted in the most effective manner and this cannot be done without the aid of written orders, acknowledgments, estimates, and so forth. Interdepartmental communications are essential to the proper conduct of understanding between the various working divisions of an industry. Communications between the sales department and other divisions, or between the engineering and production departments, would eventuate into a sorry mess were they given by word of mouth.

We have so many buck-passers in

"It must be your imagination, fellows. I can't feel any drafts out here in the shop."

LAPOINTE

CINCINNATI BICKFORD

LANDIS

Red Ring

BAKER

ILLINOIS TOOL WORKS

GIDDINGS & LEWIS

Lodge & Shipley

BARBER COLMAN

UNION TWIST DRILL CO.

CROSS

walker-turner

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Fellows

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GOULD & EBERHARDT INCORPORATED

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GREAT NAMES back of GREAT GEARS

JONES & LAMSON

MARVEL

Monarch TURNING MACHINES

J&L

WARNER & SWASEY Cleveland PRECISION MACHINERY

HEALD

In the plants of Illinois Gear & Machine Company only the finest and most advanced manufacturing equipment is used . . standard type and specially designed machines, tools and testing equipment made to Illinois Gear specifications by great names in American industry.

ILLINOIS GEARS

Reg. U.S. Pat. Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

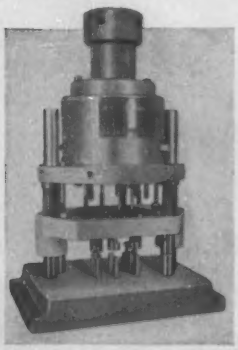
2108 NORTH NATCHEZ AVENUE - CHICAGO 35, ILLINOIS

Zagar Self-clamping
DRILL JIGS
NOW STANDARDIZED for
DRILLING, REAMING, TAPPING

9 sizes—
5 combinations per size—for
hole patterns 3" through 15" dia.

Standardization makes for quick delivery and attractive price. Only a few minor parts need be made. Speed up machining operations. The operator merely feeds the parts—the Zagar Self-clamping Drill Jig does the rest. Zagar drill jigs are now "off the shelf".

◆ ◆ ◆



Zagar drill jigs can be used in conjunction with Zagar gearless multiple-spindle drill heads to ream, drill, and tap on standard drill presses and tapping machines. Or, Zagar can quickly supply the complete "package" unit.

◆ ◆ ◆

Write for New Bulletin "A-6".

ZAGAR TOOL, INC.
24000 LAKELAND BLVD., CLEVELAND 23, O.

Zagar TOOLS For INDUSTRY and SPECIAL MACHINERY

industry, as well as untold persons who delight in alibiing their way out of difficulties, not to mention the numerous individuals whose words cannot be depended upon, that if it were not for written orders and messages business would go into a bewildering tailspin of confusion.

It is for this reason that the shop foreman is, of necessity, obliged to put up with a certain amount of paper work in order that he may conduct his business with dispatch. It is surprising how the dreaded red tape aids the smooth-running machinery of production. However, it is to be regretted that there are people who are obsessed with forms and go too far in their application.

If a man has twenty or more men in his department—all working on different jobs, it is obvious that verbal understandings are out of the question and must be replaced with written orders and messages. Although the use of paper work deprives the foreman of considerable time from other duties, it is a certainty that he would be lost without it.

Harrison Mitchell
Topeka, Kans

OUR FOREMEN SPEND too little time on paper work, thereby wasting my time, and causing errors to occur due to misunderstood verbal instructions.

My job is in the office, as bookkeeper, secretary, etc, and until recently I was the only girl in the office. Information was never available to me when I phoned the shop, and so much of my time was being wasted that my own work was being neglected.

Several months ago I spent three hours instituting a method whereby our foremen could keep the simplest

"Now don't get excited, Doris! It's just quitting time—I hope!"

NEWCOMER
Controlled Quality
CARBIDES

for greater
Production Economy

From start to finish, NEWCOMER CARBIDES are made in our own plant . . . to high controlled-quality standards.

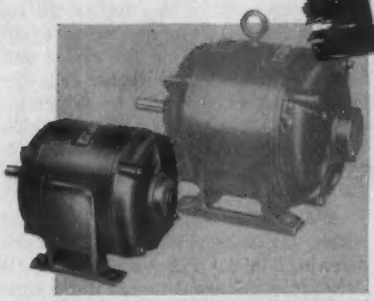
NEWCOMER CARBIDES are made to give you greater production economy through heavier feeds, faster cutting speeds and greater wear resistance than most other carbides. Complete stocks of standard carbide blanks, cutting tools, and mechanically-held tools are available for ready delivery.
For your particular cutting problem, consult a Newcomer Tool Engineer . . . there's one located near you.

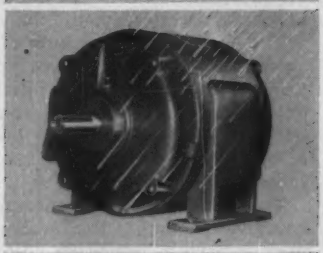
NP
NEWCOMER PRODUCTS, INC.
Latrobe, Pa.
General Sales Office:
512 Franklin Ave., Pittsburgh 21, Pa.

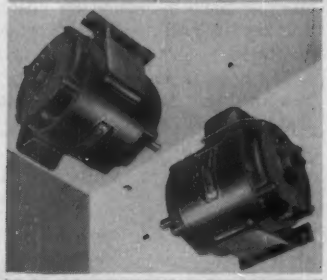
NEW Century Performance-Rated® INTEGRAL H.P. MOTORS

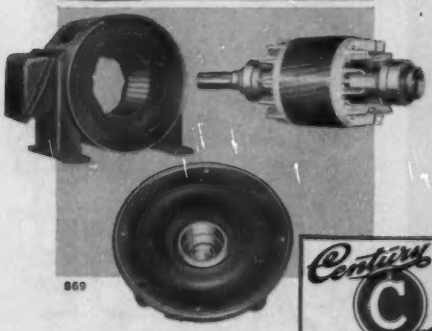
Now available in 1 . . . 1½ . . . 2 H.P. sizes— NEMA frames 182 and 184.

Improved Motors to match your needs









869

SMALLER — LIGHTER

More uniform silicon-laminated steel; thinner, *tougher* "Mylar" slot insulation — just two of the many technical developments that help make these new Century Performance Rated Motors so much *smaller* and *lighter*.

BETTER PROTECTION

New concepts of internal motor ventilation permit end bracket and frame design that gives far better protection from falling liquids and solids . . . still maintain 40°C. temperature rise.

MORE FLEXIBLE MOUNTING

You can even have cushion mounting with these new Century Integral H.P. Motors — your choice of sleeve or ball bearings. Ball bearing motors mount vertically, upside down, in any position. End brackets can be rotated for top protection in any position.

EVEN MORE DEPENDABILITY

Improved plastic impregnating varnish and plastic insulated magnet wire provide unusual resistance to abrasion, moisture and heat. These new materials possess far better dielectric qualities. Die cast aluminum rotors are individually, dynamically balanced to assure freedom from vibration.

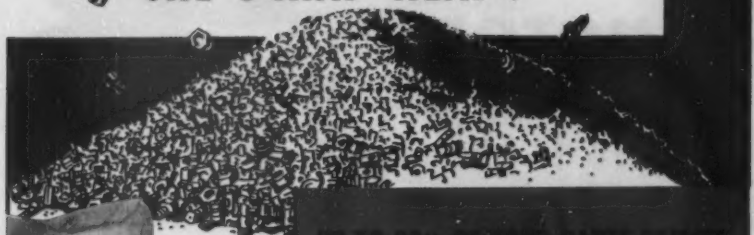
Century C MOTORS

Specify CENTURY Performance Rated motors for your equipment. Call a Century District Sales Office or your nearest Century Authorized Distributor.

Offices and Stock Points in Principal Cities

CENTURY ELECTRIC COMPANY • 1806 Pine Street • St. Louis 3, Missouri

ARE YOUR PRODUCTION AND PROFITS GOING INTO THE SCRAP HEAP?



CHECK NUT

PAT.

AVAILABLE IN FOUR TYPES

REGULAR —Type A
for normal supporting

INVERTED—Type B
Reverse of Type A support

TEE HEAD—Type C
used with sliding V-blocks

ADJUSTABLE—Type D
set your own holding pressures

UP TO 80% OF YOUR PARTS REJECTS AND FIXTURE REWORK COSTS CAN BE ELIMINATED WITH THE VLIER AUTOMATIC TORQUE THUMB SCREWS

HERE'S WHY—

VLIER Torque Thumb Screws are simple holding tools that give controlled support for even fragile work pieces against machine tool pressures. An automatic ball check in the head prevents further tightening once a pre-determined holding pressure is reached. Thus, no distortion—no rejects. These tools are operated by finger pressure only, and work without fail in noisy, greasy or dark places because they are automatic. Accuracy and uniformity are guaranteed and there is nothing to wear or break. It will pay you to apply VLIER Torque Thumb Screws to your production problems.

Send for Catalog No. 5

VLIER

VLIER ENGINEERING, INC.
4552 BEVERLY BLVD., LOS ANGELES 4, CALIFORNIA
Distributors of Spring Plungers, Spring Stops, Fixture Keys, Toggle Pads.

of records but would be able to give me information about any order at a glance. I brought their record up to date at that time, but it has never been used since. It only required that they list orders as they receive them, by number, customer name, date in shop, date completed, and expected shipping date.

They are only given eight or nine large orders each day, which would mean a very little time spent to insert dates where applicable. These dates are the answers to all of the customers' questions when they phone me. Instead of having this information readily available, it is necessary for me to suggest calling the customer back in 15 minutes, go into the shop, wait while the foreman runs around locating the order and determining whether or not is is finished, and when it will be shipped—the very same information which could have been found in his book had the dates been inserted upon completion of the orders.

It should be apparent to them that their argument, namely that such writing takes too much time, is groundless, since so much more time is spent at a later date.

This is only one example of how much time and profits are wasted through refusal to keep written records; not to mention the inconvenience caused the customers because of our delay in answering their inquiries.

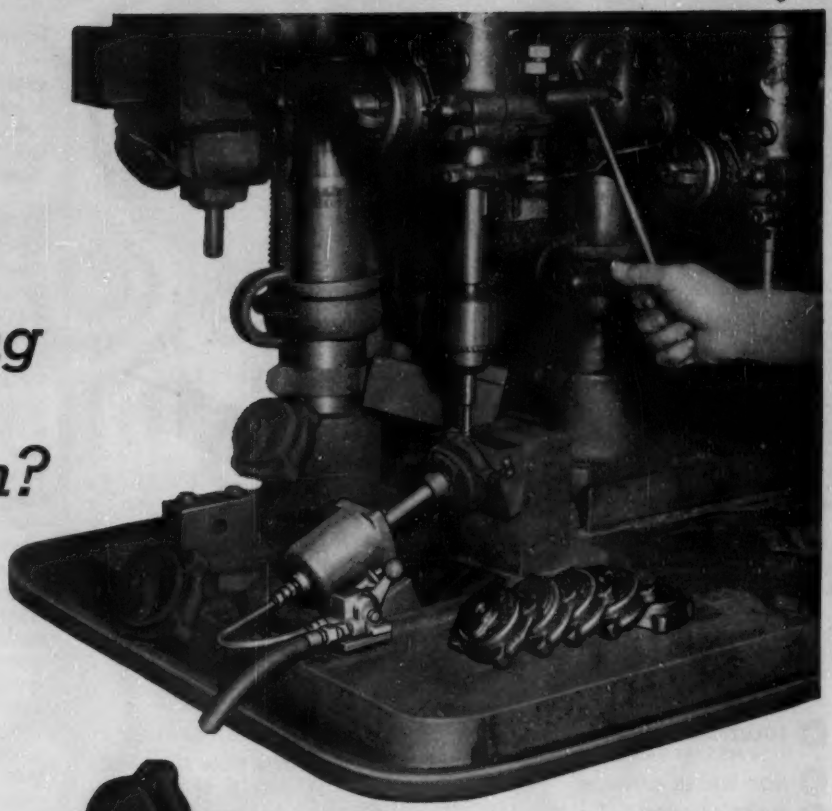
The same difficulty is encountered concerning merchandise received, orders or parts returned by customers for repair, and our all-important inventories.

My hope is now that possibly after reading the replies to this Round Table discussion they will see how wrong they've been.

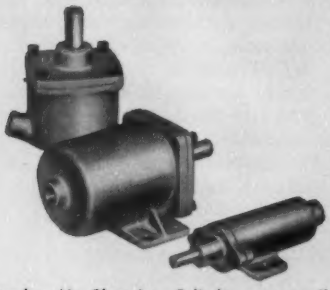
Catherine Molloy
Bronx, NY

"No, I don't think it's hot—if anything it's a little cool!"

Clamping Problem?



SCHRADER has the answer!



Schrader Air Clamping Cylinders are available either base or leg mounted, in 1", 2¼" and 3" diameters delivering a 2" or 1" stroke. A wide selection of Schrader Valves is available to operate this equipment.

Schrader

REG. U. S. PAT. OFF.

Leaders in air control since 1844

The **Schrader Air Clamping Cylinder** is actually a bantam air cylinder that can *add several minutes* to each worker's production hour . . . eliminate the need for slow, manual clamps.

Think of all the clamping operations in your own shop. Milling machines . . . drill presses . . . power presses . . . welders . . . gluers — and many dozens of other machines that are now idling for ten or fifteen seconds while operators go through slow clamping operations. Why not save time — and operator annoyance — with fast, convenient Schrader Clamping Cylinders, as so many other industrial plants have already done? Remember, you can mount these Schrader Clamping Cylinders anywhere — and actuate them automatically or manually.

For full details on the models available — or any of the hundreds of air control products in the complete Schrader Line — write today. Or, if you prefer, fill out the coupon below.

A. Schrader's Son
Division of Scovill Manufacturing Company, Incorporated
454 Vanderbilt Avenue, Brooklyn 38, N. Y., Dept. F-5

I am interested in more information on _____

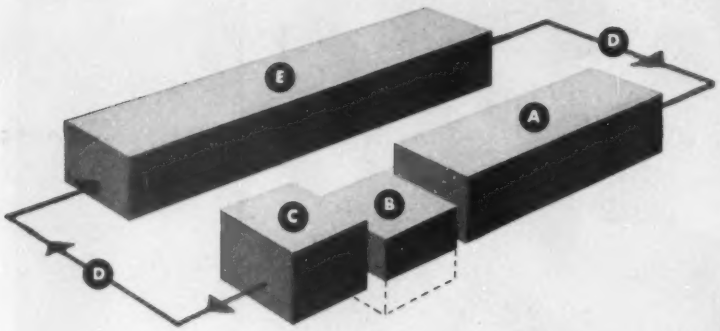
Name _____ Title _____

Company _____

Address _____

Heat Treat Furnace Layout

by *Holcroft* ... 7th of a Series



- A SOLUTION FURNACE (8 HRS. @ 940°F.)
- B HOT WATER QUENCH
- C BLAST QUENCH
- D AUTOMATIC TRANSFER
- E PRECIPITATION FURNACE (13 HRS. @ 460°F.)
- F TRAY TRANSFER

Controlled Heat Treating of Forged Aluminum Parts

A battery of five installations like the one above—each over 100 feet long—treats 11300 pounds of aluminum forgings every hour in a government project in the midwest.

Parts go through a solution furnace and then are either quenched in hot water or blast cooled with air. Forgings are automatically transferred to a precipitation furnace where they are age hardened. Temperatures are held within plus or minus 5°F.

Tough job? Not particularly! All Holcroft installations, from the smallest to the largest, can be designed around automation—the elimination of the human element. On top of that, when necessary, furnaces can tie right into the production line.

It doesn't take long for installations like these to pay off in a BIG way! Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Michigan.

BUILT BY HOLCROFT & COMPANY DETROIT 10, MICH. — PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • HOUSTON, TEXAS • PHILADELPHIA, PA.

CANADA
Walker Metal Products, Ltd.
Windsor, Ontario

EUROPE
S. O. F. I. M.
Paris 8, France

WE HAVE HEARD foremen ask themselves and others, "What are we supposed to be, clerks?" The answer is no. The foreman, as part of management, is paid to be a leader of men, not a keeper of records or a filler-inner of forms.

In a well-managed enterprise a foreman analyzes his job. The analysis must be approved by the superintendent. Clerical work is not stressed. The foreman is paid according to the nature of his duties and responsibilities. Let us listen to a foreman talk about his job.

"My job is to supervise men in the processing of material to be sold at a profit. It concerns human nature, raw stock, engineering principles, and costs. An endless effort must be made to satisfy the wants of the worker and the wants of the enterpriser. Workers want to feel important, to be appreciated, to have security, to be well-paid. Enterprisers want their property conserved, dividends on their investment, growth for their capital. These wants can be satisfied by producing a high-quality product at low cost on schedule."

Many enterprisers train their foremen on the job. One successful corporation gives them courses in economics, labor relations, materials processing, and cost accounting. Staff specialists are available for consultation on these subjects. Such opportunities are not provided for clerks. Clerks are tied up with routine tasks. The foreman is not expected to know everything about any one subject or to devote too much of his time to one particular task. There are many sides to a foreman's job. He must devote some time to each aspect of it.

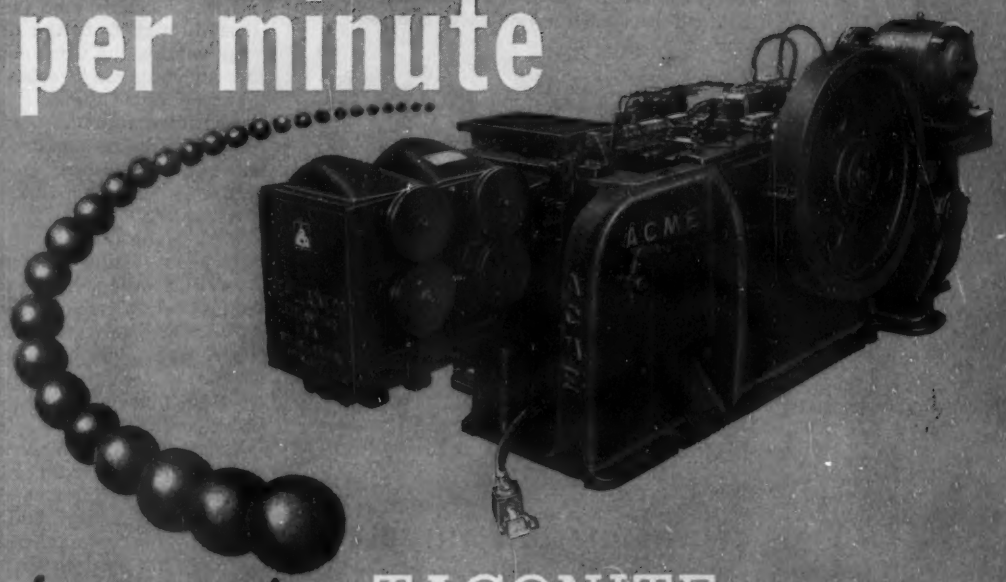
A foreman might divide his day into eight equal parts:

1. Employee relations
2. Quality control
3. Production control
4. Cost control
5. Staff contacts
6. Line contacts
7. Clerical work
8. Thinking

Each of these parts should contribute to one purpose. This purpose is to produce a high-quality product at low cost, on schedule.

The foreman's job presents opportunities for creative and satisfying work. Excessive red tape and paper work take up time which may be devoted to more creative work. Some records must be kept, some forms filled in. Accountants need facts and figures from the foreman to determine true costs and to control inventories. A foreman may keep a log

Forging 135 steel balls per minute



for processing TACONITE

The tremendous possibilities presented to the steel industry through the processing of low grade iron ore (TACONITE) has resulted in unusual interest in methods for the production of steel balls by hot forging. Illustrated here is an ACME 1" Ball Forging Machine for the continuous production of hot forged hard steel balls from ½" up to and including 1", made from stock diameters smaller than the nominal size of ball.

Operated by one man, this ACME Forging Machine automatically feeds bar stock through the feed rolls at the proper speed for maximum efficient operation of the machine, producing 135 balls per minute, with adequate safety devices to prevent jamming of the die.

Complete information is available for all those interested in the details of this special purpose ACME Forging Machine. Made in 1" and 2" capacities.

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1207 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES, HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

18% BIGGER BARREL

Gives Faster, Easier More Accurate Measurements

There's more space between graduations making it easier to estimate fractions of thousandths. There are longer graduation lines and the rapid reading figures marking each thousandth are larger. Non-glare Chrome-Clad satin finish on the barrel gives you easy reading even in poor light. Lufkin micrometers are easiest to adjust, too — the reading line keeps its original position directly in line of vision and the thimble doesn't cover measurements on the hub.

New LUFKIN BIG BARREL MICROMETERS

WITH FRICTION THIMBLE

Mechanism built right into the thimble automatically stops further pressure on the measuring faces when correct reading is obtained.

WITH RATCHET CAP

A Lufkin exclusive! With the ratchet completely enclosed in the cap you can still take "one hand" measurements.

A Complete New Line To Exactly Fit Your Needs

In the new Lufkin Big Barrel Micrometers you have a choice of Friction Thimble, Ratchet Cap or Direct Feel only. You can have the exclusive new Lufkin Slip-Proof black crackle finish on the frame or Chrome-Clad satin finish. You can have any style with or without lock-nut. You can have carbide tipped anvil and spindle. The new Lufkin shorter design gives you better balance and the extended anvil and tapered frame permit you to take measurements in places inaccessible to other micrometers. You'll like the new Lufkin Big Barrel Micrometers — try the one of your choice today.

BUY LUFKIN TAPES • RULES • PRECISION TOOLS FROM YOUR DISTRIBUTOR

312 THE LUFKIN RULE CO., SAGINAW, MICHIGAN

132-138 Lafayette St., New York City • Barrie Ont.

book to refresh his memory. It is impossible to keep track of numerous details through verbal orders alone. The experienced foreman tries to divide his time so that he may pay proper attention to all of the factors which make up his job.

Peter A Seward
West Lynn, Mass

IT SEEMS TO ME that Ed's gripe about written orders is a little far-fetched.

Even in his own department written orders must be given his men, and in a machine shop these orders come through from the department head wanting the work done so that time and costs can be established.

These orders require no writing by the foreman doing the work; the timekeeper in his department should take care of all paper work and Ed need only instruct his men on what is wanted.

Work going through a fabrication department would be accompanied by written orders from the office of the production manager, would specify what was to be done, and would be supplemented by prints where necessary, so that very little clerical work need be performed by the foreman doing the work.

Requisitions for materials, tools, or machine parts would ordinarily be ordered by the foreman, but could be written by a clerk and the order signed by the foreman, which would cut down his order-writing to a minimum.

Unless the shop is a very small one, it would seem to me that it would be impossible to run it on verbal orders alone.

Wm C Betz
New Britain, Conn

"I wish the boss would stop hiring floaters!"

ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

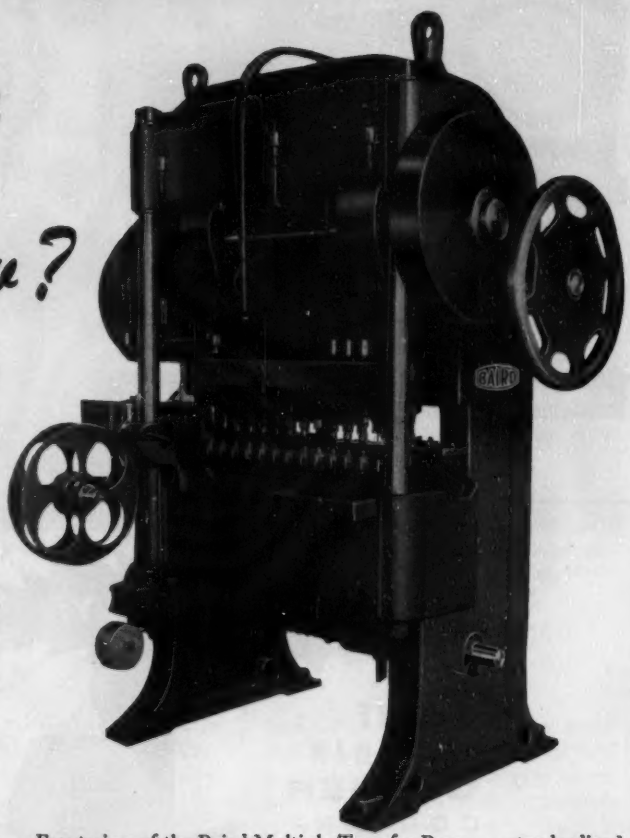
Biting off *More* than you can *Chew?*

Many types of small stamping machines can bite off coiled metal stock, but the BAIRD MULTIPLE TRANSFER PRESS cleverly chews each length into accurately formed products at the rate of thousands of pieces per hour.

Almost-human transfer fingers automatically grip and carry the work to progressive die stations where blanking, drawing, piercing, embossing, slitting, trimming, broaching, sizing, hexing, forming, etc., complete the piece.

Simply stated, the Transfer Press combines, in a single cycle, operations that otherwise might require several smaller machines with an operator for each. There are almost endless tooling possibilities . . . set-ups that turn out millions of small parts at extremely low cost.

An installation of Baird Multiple Transfer Presses puts the buyer in a most favorable competitive position in a buyer's market. Better "ask Baird about it!"



Front view of the Baird Multiple Transfer Press . . . standardized in 12 sizes with rated working pressures from 5 to 55 tons. Coiled stock from 2½" to 4" in width is automatically fed at high speeds.

SEND FOR TRANSFER PRESS BULLETIN

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

Carter MICRO-GUIDES
STANDARD EQUIPMENT ON
YATES AMERICAN BAND SAWS

Yates-American
Y-36
Band Saw

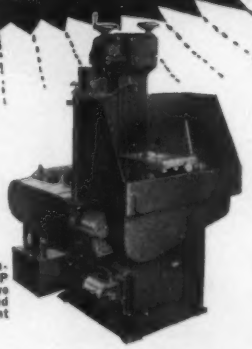
More and more leading band-saw machine manufacturers are standardizing on Carter Guides for economical, trouble-free operation.

A MODERN GUIDE FOR A MODERN SAW

CARTER PRODUCTS COMPANY, INC.
429 Wm. Alden Smith Bldg. 30 Ionia Ave., S. W.
Grand Rapids 2, Michigan

STARTS INSTANTANEOUSLY!

THE RUTHMAN GUSHER COOLANT PUMP



Illustrated is a Hammond 8" Model Y-8WP Wet and Dry Abrasive Belt Grinder equipped with a Gusher Coolant pump.

With a Ruthman Gusher Coolant Pump you get plenty of coolant when you want it, *the instant the machine is turned on.* There is no priming necessary, Gusher Coolant pumps are always ready to go to work. Pre-lubricated heavy-duty ball bearings, electronically balanced rotating assembly, with no metal-to-metal contact within the pump, assure you of less maintenance care, longer life. Send for our illustrated catalog today.

THE RUTHMAN MACHINERY CO.
1818 Reading Road, Cincinnati, Ohio

New Books...

FLOW AND FAN—*By Prof C Harold Berry, Graduate School of Engineering, Harvard University. Published by The Industrial Press, 148 Lafayette St, New York 13, NY. 226 pages. Price, $4.*

Subtitle for the text is "Principles of Moving Air Through Ducts," which the author covers from the vantage points of fan selection and control, system characteristics and flow analysis.

This is a student text, primarily, but should also be useful to practicing engineers because of the basic material available and the number of fan and flow curves. Illustrations are simple and straight-forward mainly sketches—no photos. Material is laid out in good order, covering measurements, losses of all kinds, complete systems, fan performance and selection, and operation and control.

The manuscript appeared in "Machinery" as articles, and had been originally a series of lectures. Order of chapters is not exactly normal—the author tends to present the problem and its cause first, then show solutions.

•

ASME HANDBOOK — METALS PROPERTIES—*Edited by Samuel L Hoyt, metallurgical consultant, Battelle Memorial Institute. Sponsored by Metals Engineering Handbook Board, ASME. Published by McGraw-Hill Book Co, Inc, 330 W 42nd St, New York 36, NY. 433 pages, 7x10 in. Price $11.*

This is the second volume of the new ASME 4-volume handbook. Already published is *Metals Engineering—Design* (*AM*—Mar 1 '54, p206), while *Metals Engineering — Processes* and *Engineering Tables* are now in press.

This volume assembles property data on more than 500 metals. Included are iron, steel, and the alloys of copper, aluminum, nickel, zinc, lead, tin, magnesium, and the new "super alloys".

A skeleton format has been adopted to present data in uniform manner for each material. This indicates where there are omissions in available data and provides space for the user to write in new information of

interest. In general, listing for each metal includes composition, characteristics, uses, common forms, mechanical properties, treatment temperatures, and other pertinent data.

All metals of one basic type are grouped together, generally arranged in ascending order according to the most commonly used system of identification in each case. There are some departures from this system necessitated by publication limitations and some other departures that were not necessitated by this requirement. There are also some errors in indexing. Neither of these defects detracts from the basic usefulness of having a large volume of basic data in a single volume.

•

HANDBOOK OF INDUSTRIAL ELECTROPLATING (2ND EDITION)—*By E A Ollard and E B Smith. Published by Iliffe & Sons Ltd, London, England. 364 pages, 8¾ x 5½. Price $6.75. Available from British Book Centre Inc, 122 E 55th St, New York 22, N.Y.*

In the few years since this book was first published (1947) it has become established as a standard work for the practical plater. Leaving out all theoretical material, it deals with the practical aspects of installing, maintaining, and operating a plating plant or department.

The new edition contains new sections dealing with water and drainage, solution purification, safety and ventilation, and the problems of costing. Many new formulas, as well as the details of the latest advances in testing deposits are given. Several additional reference tables have been added.

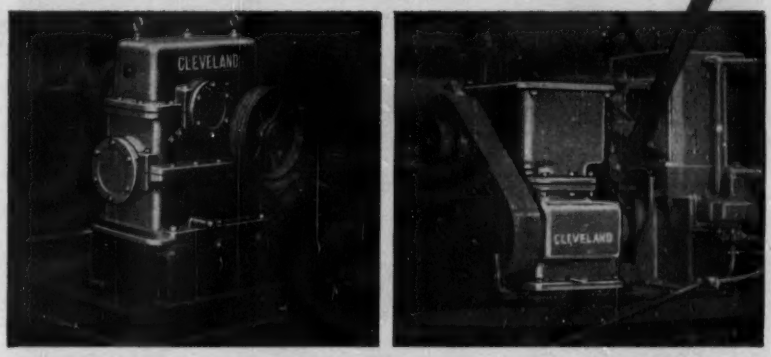
If there is one drawback to the book, it is that the solution formulas are given, quite naturally, in British Imperial gallons, and users in the US should be cautioned to apply the necessary conversion factors.

•

PRODUCTION GUIDES AND CONTROLS FOR THE MODERN EXECUTIVE—*Published by the American Management Association, 330 W 42nd St, New York 36. 52 pages. 6 x 9 in. Price, $1.25 (non-members), $1.00 (members).*

Recent advances in the field of "scientific management" have outmoded many ideas which used to suffice in an earlier era. This book is an attempt to indicate the latest thinking in several phases of the manufacturing organization. Subjects

CLEVELAND "Siamese twins"



One large Cleveland and two smaller vertical worm gear units operate this Medart No. 3 RFPD machine which cold-finishes steel bars at the rate of 12 feet per minute.

feed and discharge bars

HEART of the feed and discharge mechanism of this Medart Centerless Bar Turner is a trio of Cleveland worm gear speed reducers. One large Cleveland unit drives cold-finished bars through the cutterhead. The "Siamese twins", two Cleveland vertical units mounted head-to-head, pull the workpiece back at speeds of 3 to 12 feet per minute and then return the carriage at 75 feet per minute for a new workpiece.

CLEVELANDS SAVE SPACE

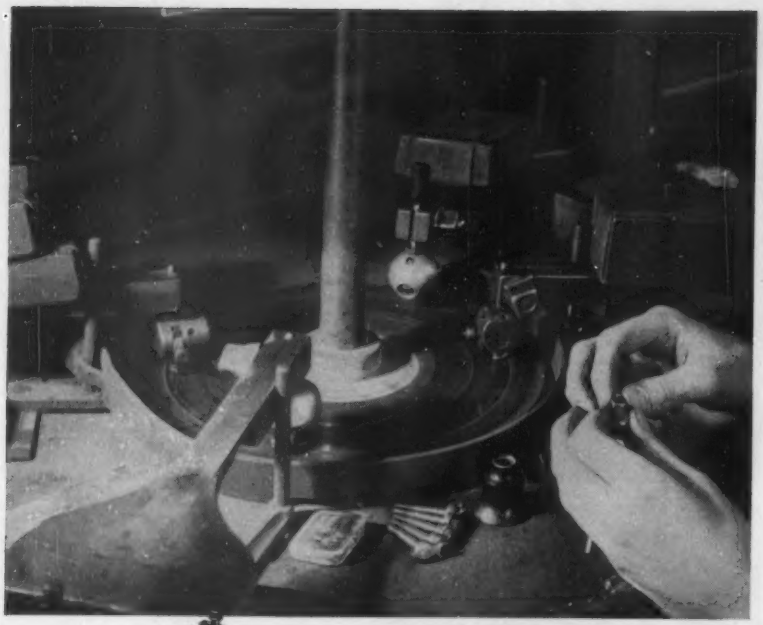
This unusual Cleveland installation demonstrates how vertical and right-angle worm gear drives can save valuable space and streamline machine design. Functional design is just one Cleveland advantage. Another is Cleveland's dependability and long wear. Sliding action of case-hardened steel worm on nickel-bronze gear transmits power with a smooth, uninterrupted torque flow.

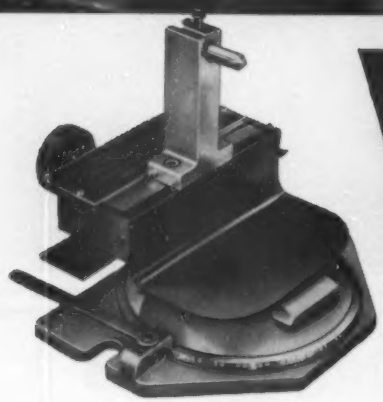
GET FREE CATALOG

For the best in worm gear drives, get those made by a worm gear specialist: Specify Cleveland! Write for free Catalog 400. The Cleveland Worm and Gear Company, 3254 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

CLEVELAND
Speed Reducers





A Specialist is Your Best Bet

The specialists who produce Vinco B-1 angle tangent to radius Dressers have skill and experience equal to that of industrial diamond cutters. The B-1 Dresser will dress contours on grinding wheels to an accuracy within .0001". This accuracy is assured for the life of the dresser by its good design, sturdy construction and anti-dust features. The B-1 Dresser can be used on surface grinders as well as internal, external, "multi-purpose" and tool and cutter grinders. Its accuracy and simplicity of operation take all of the "guess work" out of wheel dressing.

FREE! Send today for this booklet. It tells all about the B-1 Dresser . . . has tips on dressing angles tangent to radii.

VINCO CORP., 9125 Schaefer Hwy., Detroit 28, Mich.

Mass Produced Metal Component Parts • Aircraft and Commercial Gears • Master Gears • Spline Gages • Precisiondex • Gear Rolling Inspection Fixtures • Recording Camshaft Comparators • Optical Master Inspection Dividing Heads • Involute Checkers • Indicator Snap Gages.

TRADEMARK OF DEPENDABILITY

VINCO®

MILLIONTHS OF AN INCH FOR SALE

covered are production planning, marketing in "hard-sell" times, operations research, predetermined time studies (MTM), and theory and practice of work sampling.

Some of the subjects treated in this book fare somewhat better than others. For example, the first section, on overall planning, is too wide a subject to handle in a short space, and the resulting discussion is altogether too vague to be of much use. The second section, on marketing in competitive times, is much more interesting, telling the principles to which General Electric is committed in trying to meet the challenge brought on by the end of "order-taking" sales.

The third section, an operations research, although incomplete because of a lack of space, reflects what seems to be a very valuable tool for solving a wide variety of production problems, from matching sales and output, to finding incentive times for "unanalyzable" operations. The stated purpose of the technique is "to study those areas where measurement is possible with a view to narrowing down the area where the executive has to use his judgment unaided."

The sections on MTM and work sampling are typical basic discussions of two techniques which are becoming much more widely known and used. Although there is nothing startling in these discussions, they do provide useful fundamental knowledge from which to work.

•

GEARS FOR SMALL MECHANISMS — *By W O Davis. Published by N A G Press, London W 6, England. 157 pages, 5 x 8¼. Price, $5.*

Small gears, according to the author, have been greatly neglected in the recent past. The reason seems to be that larger gears subject themselves to theoretical analysis much more easily than small gears. As a result, anyone who speaks of "cycloidal gears" is brushed aside by engineers who have concentrated on "involute gears."

As the subject of watch and instrument gearing has become much more important recently, this book, reported to be the only one of its kind, should be most welcome by those whose problems take them into this specialized field.

The problems peculiar to small gears derive from the fact that gears in general are relatively hard to make to modern tolerances, and small gears in particular exaggerate this situation. The book in question

Keller Compression Riveters

give a squeeze ...not a wallop

Metal-plastic relay spindle

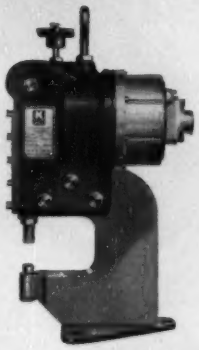
Reduce breakage when metal-plastic assemblies are forced into a pressure fit

Here is the experience of a Keller customer in manufacturing electric relay spindles, consisting of brass posts and pressure-fitted plastic collars.

Attempts to assemble by hand were slow, inaccurate, and costly. Staking the parts together with solenoid-operated power equipment had to be abandoned because the sudden, sharp impact shattered too many plastic collars and made breakage costs excessive.

The problem was solved when a tool engineer fitted Keller Compression Riveters with special lever arms. When the arms descend, the parts get an air pressure squeeze—not a wallop—and are pressed together firmly with little or no shock. Air power exerts maximum force at the end of the stroke, where it is most needed; and pressure is not released until the arm completes its full stroke.

Perhaps this characteristic of applied air power would save breakage and reduce costs in some of *your* plant operations. Have you discussed it with the Keller application engineer near you?



Keller yoke-type Compression Riveters may be used for pressing, crimping, or forming, as well as riveting.

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Pneumatic Tools

KELLER TOOL COMPANY, 1303 Fulton St., Grand Haven, Mich.

Production Line Analysis PROVES
SECOMET DIAMOND WHEELS
GRIND FASTER
LAST LONGER
REDUCE OVERALL COSTS
In a four month period under actual competitive conditions one Diamond Wheel ground 36,976 pieces, while eight silicon carbide wheels ground a total 16,023 pieces.
RESULT— 1. Less cost per piece 2. Greater Production
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See for yourself how
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gives a very lucid explanation of the logical necessity of resulting techniques, and shows why involute gearing cannot be expected to take over in the field of small gears.

Subjects covered include theory of small gears, types of gearing employed, effects of friction and resulting corrections which must be made in gear design, cutting and generating methods for making small gears (how to make small gears, and why you can't make them any other way), special types of gearing, and, finally, a chapter of miscellaneous things not brought up in earlier chapters.

Although any thorough book about gears will be difficult to read and apply, the author has done a very good job of keeping his discussion as simple and clear as possible under the circumstances, being quite frank about the limitations of the methods of small gearing. Small gears could be described as "adequate" rather than "ideal."

A series of data sheets follows the main text, describing British and American standards.

•

METALS AND HOW TO WELD THEM—*By T B Jefferson, editor, The Welding Engineer, and Gorham Woods, metallurgist. Published by The James F Lincoln Arc Welding Foundation, Cleveland 17, Ohio. 322 pages, 6x9. Price $2 in USA, $2.50 elsewhere.*

Here is a book that a lot of people have been looking for! For it combines in a single small volume a welding reference book and an instructional text. It gives the user of welding a practical working knowledge of how welds are made, and what happens to metal during the process; and at the same time gives him the information he needs for both designing and making better welds at lower cost.

Separate chapters give procedures for welding most of the common metals, how to make good welds, how to locate troubles.

There is information on metallurgy—enough to enable the reader to understand what it is all about, but not to lose him in the mazes of a highly complex subject. There is instruction on how to weld by various processes—without the lengthy detail necessary for training a professional welder. In short, it is a book that can well be read, understood, and put to practical use by welders, instructors, engineers, students, and executives.

Names in the News . . .

David F Todd has been appointed staff assistant to the vice president and general manager of Chrysler Corp's Dodge Div. Associated with the company since 1951, Mr Todd has been assistant to the general manager of the jet engine plant near Utica, Mich, for the past two and a half years.

George G Wilcox, chairman of the board of the Storms Drop Forging Co, Springfield, Mass, has been elected a vice president of the New Britain Machine Co. Mr Wilcox joined the firm in 1940 as production manager for the hand tool division, and served successively as superintendent, factory manager, and manager. He will continue to head the division in addition to directing affairs of Storms, a company subsidiary.

James R Longwell, assistant to the general manager of General Electric Co's Carboloy Dept, Detroit, has resigned from the organization. He has formed Longwell Engineering-Sales Co, consultants, which will also be sales representatives for several manufacturers of industrial equipment. Company offices were opened in Birmingham, Mich, a Detroit suburb, May 1.

Harry Lange has been promoted from assistant chief engineer to chief engineer in charge of Waterbury Farrel Foundry & Machine Co's Bolt, Nut, Screw & Rivet Machinery Div. He succeeds **Joseph M Schaeffer,** recently made president of the company. Mr Lange joined the firm in 1922 and has held his most recent post since 1947.

Edward H Wheeler, formerly chief engineer at Standard Pressed Steel Co, Jenkintown, Pa, has been made manager of the forging division, in charge of hot and cold headers, production thread rollers, and the facing and drill, broach and knurl sections. **John M Sherman,** former manager of quality control, succeeds Mr Wheeler.

Hermann A Bottenhorn, chief engineer of Hydropress, Inc's Rolling Mill Div, has been elected vice president in charge of the division. Mr Bottenhorn, who joined Loewy-Hydropress in 1946, has been connected with the organization for 30 years.

Separates 7 cu. ft. of parts and tumbling chips in just 10 minutes

STEARNS MOBILE MAGNETIC PARTS SEPARATOR

You can separate steel parts from deburring chips in minutes instead of hours with a Stearns Magnetic Parts Separator. As mixture cascades from feeder, the powerful Stearns drum-type magnet lifts parts to belt which conveys them to demagnetizer. Non-magnetic chips fall into suitable receptacle for re-use.

Make these Stearns advantages work for you!

Big Labor Saver — No hand picking or screening. No attention required while unit is operating.

Non-Choking Adjustable Feeder — Regulates flow of material . . . handles parts of various sizes and shapes.

Positive Separation — Lift principle pulls steel parts up and out of chips or deburring compound . . . eliminates entrapment of parts.

No Magnet Operating Expense — Permanent, powerful Alnico V magnet needs no current.

Completely Self-Contained Mobile Unit — No separate feeders, chutes, hoppers. Just connect drive motor to current and you're ready to operate. Mounted on wheels for easy movement around plant.

Protection for Parts — Hopper and feeder are rubber-lined.

Parts Fully Demagnetized.

Find out how a Stearns Parts Separator cuts handling costs. Write today for Bulletin 110.

1089

MAGNETIC EQUIPMENT FOR ALL INDUSTRY

STEARNS MAGNETS

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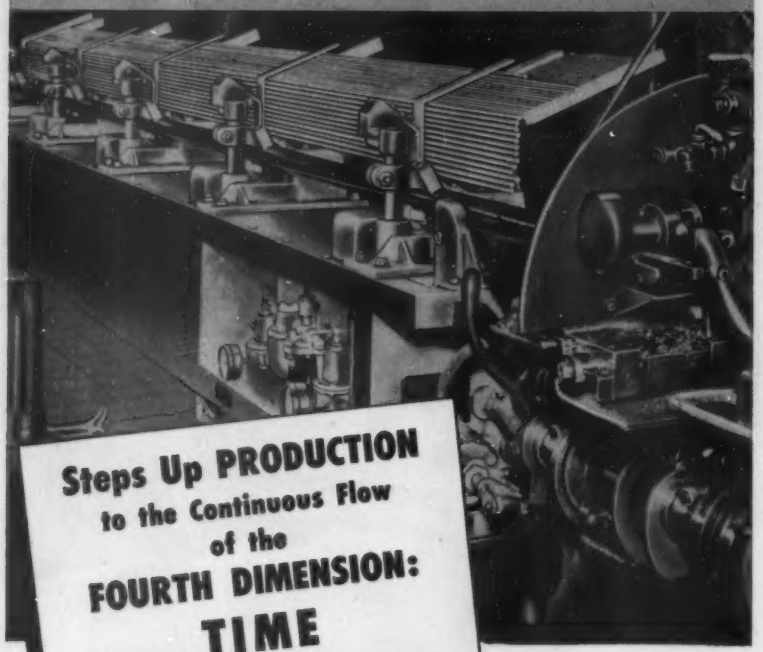
Now... A Screw-Machine-Feed that BREAKS THE TIME BARRIER!



Steps Up PRODUCTION to the Continuous Flow of the FOURTH DIMENSION: TIME

EVERY TIME a screw machine cuts air... every time feed fingers are adjusted or replaced... every time remnant removal forces a shut-down — *that's time lost forever, never again to be made up in the production quota!*

In the modern Lipe Automatic Magazine-Loading Bar Feed, we present a continuous-feed mechanism that utilizes *every minute* of the working day for production...and still more production.

There's *No* cutting air. *No* feed fingers. *No* remnant problem. *No* minimum or maximum run. *No* limit on length of feed. *No* selective stock length requirement.

There IS a definite increase in production — up to 100% on some installations — *at least 30% on every one!*

Send today for FREE BOOKLET giving full details on Lipe's AML Bar Feed — today's big advancement in screw machine stock feeding. We will also supply name of your nearest distributor.

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Manufacturers of Automotive Clutches and Machine Tools
Syracuse 1, N. Y.

J F Schirtzinger, former Convair engineering executive, has been appointed president and general manager of Consolidated Tool & Products Co, Los Angeles. He succeeds the late **Anthony Oberholtz,** who died last year. For the past five years Mr Schirtzinger has been assistant chief at Convair's San Diego division. Prior to that he was engineering consultant for the company and the Prototype Engineering Corp, Inglewood, Calif.

Sidney Andrews has been named vice president in charge of research and development for the Metal Removal Co of Chicago. He will be engaged in work on the firm's abrasive grinding wheels, disks, and mounted points. Mr Andrews was formerly associated with the Bay State Abrasive Products Co, Westboro, Mass.

Walter W Hambrecht has been made manager of Standard Pressed Steel's Finishing Div. Mr Hambrecht, formerly assistant to the supervisor of form and finish, will be in charge of all hand machines, drilling and grinding, and of the rolled thread and plating departments.

Frank A Benoit, Jr, has been appointed foundry and pattern shop superintendent of Brown & Sharpe Mfg Co, Providence, RI; he succeeds **LeRoy M Sherwin,** who has retired. Associated with the firm for many years, Mr Benoit was made foreman of the pattern shop in 1939, and last year became assistant superintendent of the foundry.

C E Root has been named vice president of US Spring & Bumper Co, Los Angeles firm recently acquired by Rheem Mfg Co, Oakland Calif. Mr Root will continue his duties as container sales executive for Rheem.

Waldemar Naujoks has been elected vice president and general manager of Globe Forge, Inc, Syracuse, NY, subsidiary of Barium Steel Corp. For the past five years Mr Naujoks has been serving as special projects engineer at Ladish Co, Cudahy, Wis, and prior to that was chief engineer at the Steel Improvement & Forge Co, Cleveland.

Edmund C Sedlack has been named administrative assistant to the manager of Westinghouse Electric Corp's Aviation Gas Turbine Div. Formerly with the aviation division of the Studebaker Corp, Mr Sedlack served as aviation engineer responsible for all engineering activity in connection with Studebaker's license on its General Electric J-47 engine contract.

Ben Duffy, President of Batten, Barton, Durstine & Osborn, Inc., tells why:

"You don't have to wait for Groucho!"

"Snap on your TV set Thursday night—there's Groucho," Ben Duffy points out, "and he never fails to be there.

"You—and BBDO—can thank Air Express for that. It's Air Express that carries Groucho's films regularly.

"TV films are always due at a certain hour, often the whole way across the country. The same with printing plates. They may have to reach 100 different cities to make a specific edition of many publications.

"Air Express gets these essential materials there—every day in the year. It's the most reliable service we know.

"Frequently, we send duplicate shipments in case one should be marred or lost in handling—but this precaution has never once been necessary.

"Important, too, is the fact that almost all our shipments—more than 1,000 a year—cost us less with Air Express than with other air services."

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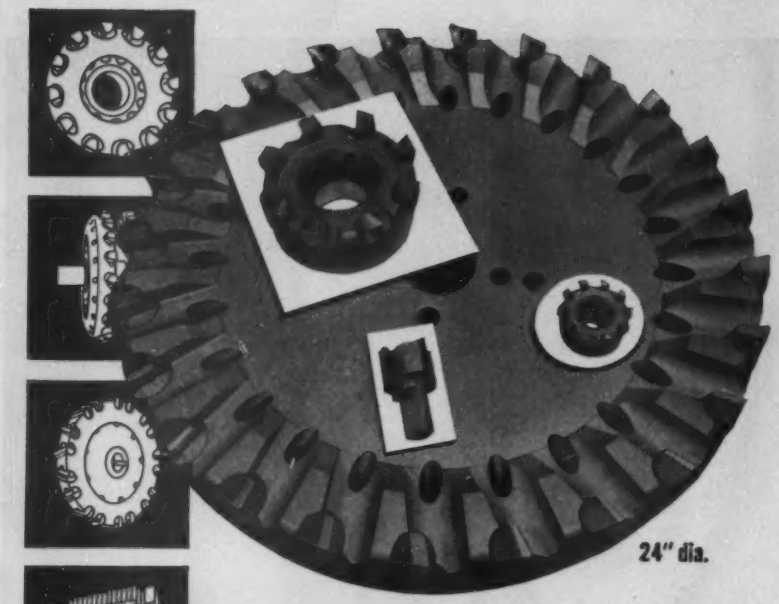

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...what's more, Lovejoy is set to give good delivery. Lovejoy's large engineering staff and modern manufacturing plant offer every facility for prompt production of standard milling cutters, as well as specials to meet unusual requirements.

The advanced design of Lovejoy mills offers unusual interchangeability of inserted blades and wedges in practically all styles and sizes, whether standard or special. Users appreciate the economy of this feature. And, no matter what the age of your Lovejoy housings, blades of H. S. S., alloy and carbide are promptly available from stock.

Our 35 years' experience in designing and building standard and special mills, *in all sizes*, can help you get the best results, economically, on all milling operations.

Write for free catalog!

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TOOL COMPANY, INC.

L H Remiker has been named head of Lindberg Engineering Co's newly-formed Field-Erected Equipment Div. The unit has been formed to expand the company's facilities for specializing in large, field-erected industrial furnaces, special machines, and complete production lines. Mr. Remiker has been chief engineer of the organization for the past nineteen years.

Nelson H Mageoch has been appointed vice president of Daystrom Instrument, a division of Daystrom Inc, at Archbald, Pa. He will continue to direct engineering and research activities as well as industrial engineering, equipment installation, inspection and test, and the firm's pilot plant operation. **Howard J Warnken,** director of sales and contracts, has also been named a company vice president.

W F Beckley, Chrysler Corp divisional purchasing agent and coordinator of material procurement for all the company's defense projects, has retired. Mr Beckley joined Dodge Brothers in 1921; after Chrysler purchased Dodge in 1928 he was appointed staff assistant to Chrysler's general purchasing agent. In 1945 he was made divisional purchasing agent, and a year ago was appointed coordinator of material procurement.

T J Ault has been named president and general manager of Borg-Warner Corp's Detroit Gear Div. The former vice president and assistant general manager succeeds **A P Emmert,** long-time B-W executive, who in July, 1953, interrupted his retirement and temporarily accepted general managership of the division. Prior to joining the executive staff of Detroit Gear in August 1953, Mr Ault was vice president and purchasing agent of the organization's Warner Gear division.

Joel Hunter has been elected president of the Crucible Steel Co of America. He succeeds **William H Colvin,** head of the company since 1945, who will continue as a member of the executive committee and board of directors. Mr Hunter joined the organization in 1951 as vice president in charge of finance, and was elected a director and executive vice president last year.

John H Nelson has been named works manager of Kropp Forge Co's Chicago plant. Mr Nelson, who joined the firm in 1948, moves up from his post as assistant. He was previously associated with Harvey Metal Corp, Chicago, as vice president in charge of forging production.

Angell Completes Major Pressroom Modernization with 16 New Presses... All Bliss-Built!
DAYTON, Ohio—New stamping capacity will put Angell Manufacturing Company in the "best competitive position in its history", R. H. Walker, company president, said today. He explained that the addition of 16 new Bliss presses has increased the company's capacity by 50%. Angell manufactures embossed, etched and lithographed nameplates, dials and escutcheons.
Angell decided to place all their press business with Bliss after years of experience with several makes of stamping presses. According to Mr. Walker, the Bliss presses were selected for their dependable operation, ease of set-up and maintenance, and reliable clutch performance.
BLISS
S-175-27-33
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THERE MUST BE A REASON why Bliss presses are the unanimous choice of so many large contract shops. Dependable equipment? That's for sure: industry *knows* when it buys Bliss it buys designs that have stood the test of years.

To learn how Bliss presses can fit into your modernization plans, call for a Bliss engineer today.

175-ton straight side press (left) and battery of inclinable presses (above) are typical of new Bliss equipment used in the manufacture of nameplates, escutcheons and television panels.

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SINCE 1857

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PRESSES, ROLLING MILLS, SPECIAL MACHINERY

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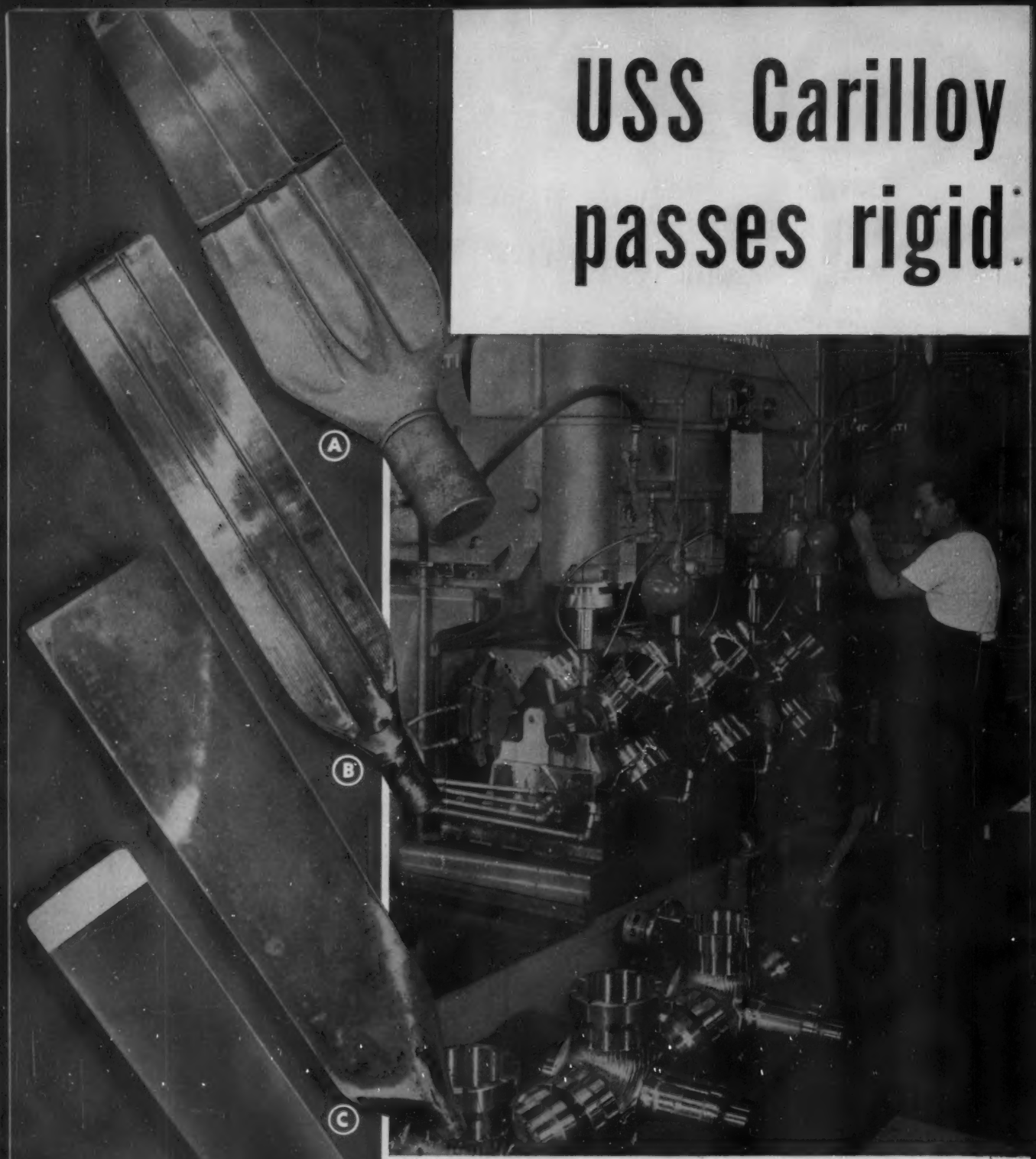


THESE HIGH QUALITY aircraft propeller hubs are forged and machined from semi-finished Carilloy 4340. They meet extremely tough magnaflux requirements.

FOR BIG PROPELLERS, 2 forged sections (**a**) are welded together to form one blade thrust member. Pieces are then ground and magnafluxed, Kellered, ground, and magnafluxed again (**b**). Mill camber sheets (**c**) then are copper brazed to the thrust members. Entire unit is heat treated and polished before final magnaflux test and cadmium plating. Rigorous magnaflux testing assures that every finished blade (**d**) can withstand the tremendous stresses encountered on the latest high-speed planes.

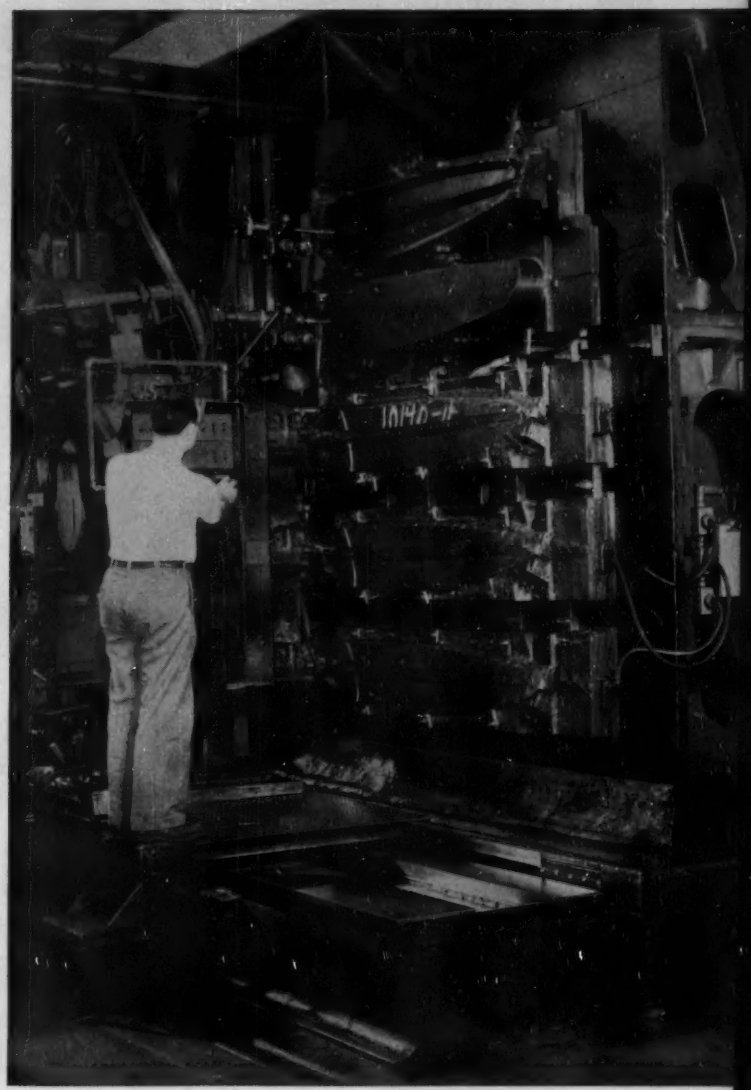
steel tests for propeller blades

An important manufacturer of propellers for military aircraft has found that in stringent magnaflux tests, USS Carilloy steel performs completely satisfactorily.

The high stresses in propeller blades and hubs naturally require extremely high quality steels. Accordingly, the U.S. Army and U.S. Navy have set up rigid quality specifications requiring that every heavily stressed part must be magnafluxed several times during its production.

With USS Carilloy 4340 electric furnace aircraft quality steel, this important manufacturer is able to count on the performance required for this severe application. The consistent high quality of USS Carilloy aircraft steel has meant greater savings to this customer through minimum magnaflux rejections of costly fabricated parts.

USS Carilloy steels have established an enviable record for meeting the highest quality requirements. Therefore, when you need a standard AISI analysis or a special steel for an unusual application, it pays to call in a USS Service Metallurgist. He can help you solve any steel problem.



AFTER FORGING AND MILLING, 750-lb. thrust sections are hogged out on this Kellering Machine. Finished sections weigh about 155 lbs. USS Carilloy steel maintains a No. 1 quality position on these heavy-duty parts.

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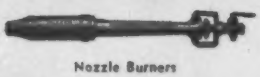
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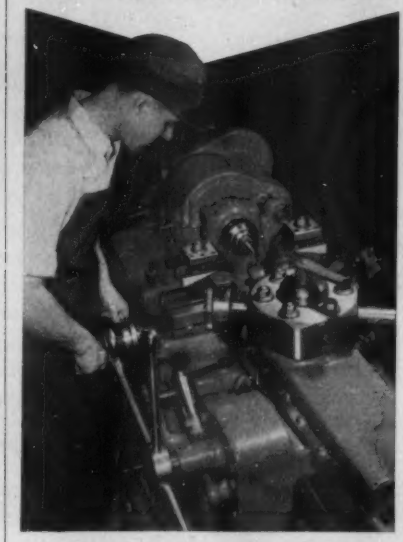

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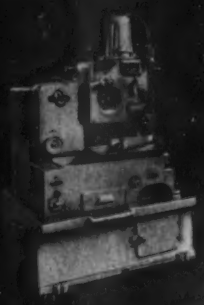

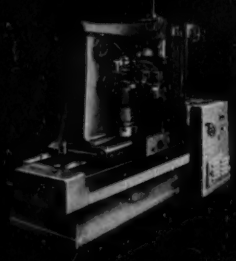

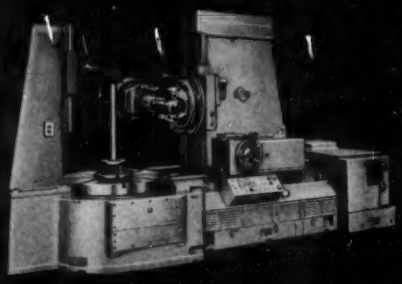

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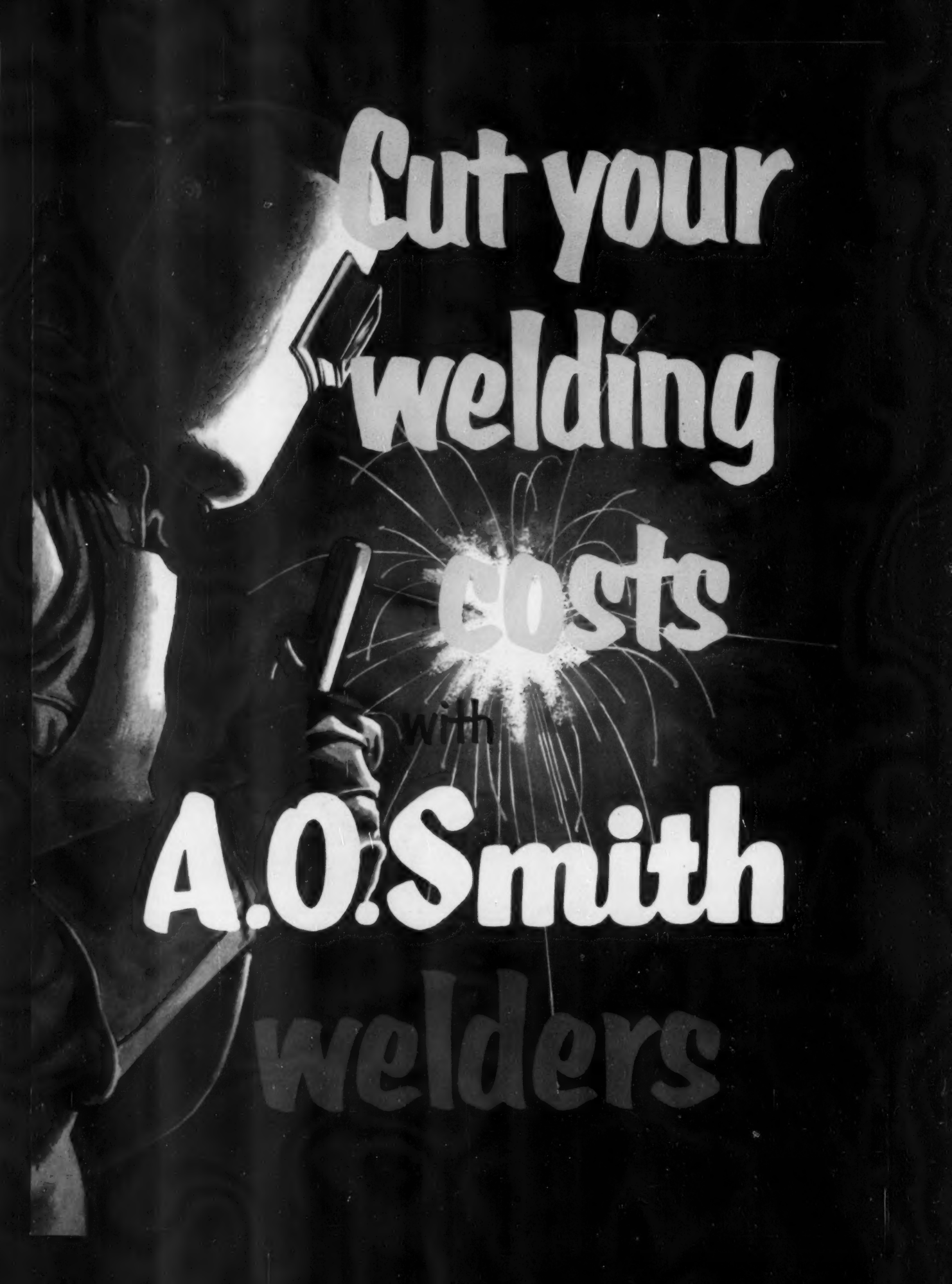
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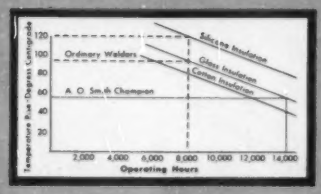
Designed and long proved the most dependable power source for continuous operation on the most demanding welding assignments at full rated output.

The **CHAMPION** has enough copper, plus downdraft ventilation, to assure no more than a 55° C. temperature rise when operating at full rated output. This means almost twice the operating life of any comparable heavy-duty welder!

75 open circuit volts for high-speed welding with a faster and smoother arc! You can "drag the arc" on rapid work and weld low-hydrogen electrodes without "pop-outs." All-weather case makes it as useful outside as in the shop. Available in 300-, 400- and 500-amp models.



The **A. C. UTILITY** for **farms, garages, machine shops** with dual welding range: 25-90 amps., 35-180 amps

extra benefits

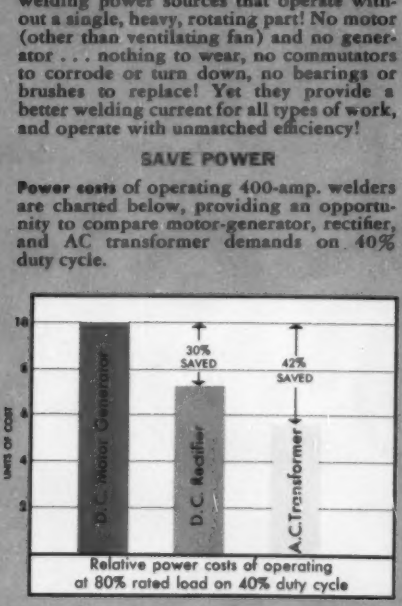
which A. O. Smith design and engineering provide!

D. C.
RECTIFIER
heavy-duty welder

Here is a complete line of N.E.M.A.-rated welding power sources that operate without a single, heavy, rotating part! No motor (other than ventilating fan) and no generator . . . nothing to wear, no commutators to corrode or turn down, no bearings or brushes to replace! Yet they provide a better welding current for all types of work, and operate with unmatched efficiency!

SAVE POWER

Power costs of operating 400-amp. welders are charted below, providing an opportunity to compare motor-generator, rectifier, and AC transformer demands on 40% duty cycle.



Relative power costs of operating at 80% rated load on 40% duty cycle

The savings in power effected by transformer type machines over motor generators result from the improved efficiency under load of the A. C. transformer (85% to 88%) and the D. C. Rectifier (69% to 72%) over the D. C. Motor Generator (45% to 50%), plus the ability of transformer and rectifier to deliver full welding current instantly, when demanded, without requiring large idle-time power to keep rotating parts in motion. The savings are real. In fact, many manufacturers have found that a new transformer will practically pay for itself in a year! Ask your A. O. Smith distributor or representative to show you how, at your next opportunity.

SAVE OTHER COSTS

You save more than power costs when M.G. sets are replaced by A. O. Smith welding machines. Rectifier and transformer welding current inherently has less arc blow, and that means higher quality welds, faster welding speeds and less spatter. It also means greater overall operator efficiency, which assures better weldments, less weld repair and gives the operator greater pride in his work. The result: more money saved and production improved!

Because there are no moving parts, A. O. Smith welders require practically no maintenance. Quiet in operation, they are built to stand up under gruelling production schedules.

Modern successor to the cumbersome, troublesome, lumbering motor-generator set! This welding power source provides smoother arc performance, more dependable amperage at all times, instant striking arcs, and uses power only when welding! It's the only rectifier-type welder designed with high-velocity down-draft ventilation, which draws cool air in over the rectifier stacks before blasting it through the machine. Even when short-circuited at full rated amperage setting, the rectifier stacks remain below critical temperature! Stepless amperage control, effortless and accurate over the full range, assures exactly the desired setting for any job. The three-phase transformer coils are precision wound, of heavy copper, for long service life. Available in 200-, 300- and 400-amp. models.

The **A. C. CHALLENGER** all-purpose welder 200-, 300- and 400-amp. models

The **A. C. AUTO-MAN** for automatic or manual use 650-amp. model, up to 4-unit multiples available

There are A. O. Smith welding power sources for every welding need, built to the highest standards in the industry and of advanced design that makes them more desirable than any other make. Job proved in the shops of the world's largest user of welding as a production tool!

It will pay you to replace M.G. sets with A. O. Smith welders. May we suggest that you write us or contact your local A. O. Smith distributor for full particulars.

A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION, Milwaukee 1, Wisconsin

INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

Highest Quality Welding Electrodes

Mild Steel	AWS Class	E6010	E6011	E6012	E6012	E6013	E6013	E6020
	A. O. Smith	SW10	SW14	SW11	SW17	SW15	SW16	SW35

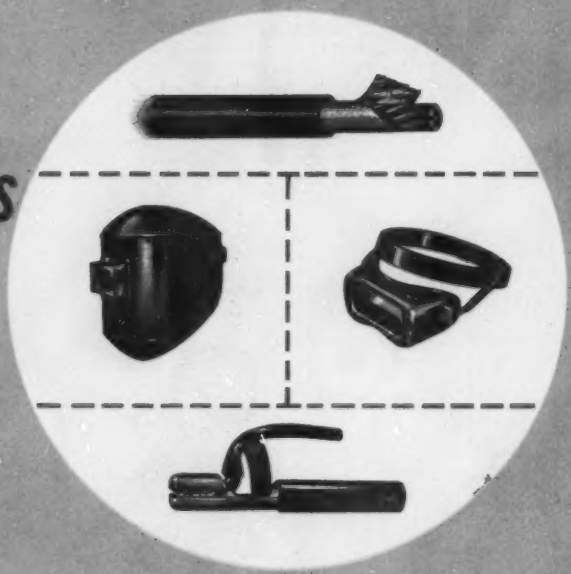
High Tensile	AWS Class	E7010	E7010	E7020	E8013	E9010	E9013	E10013	E10020
	A. O. Smith	SW75	SW80	SW76	SW86	SW95	SW87	SW88	SW101

Low Hydrogen	AWS Class	E6016	E6016	E7016	E8016	E9016	E9016	E10016	E12016	E12016
	A. O. Smith	SW94	SW85	SW84	SW81	SW90	SW89	SW100	SW120	SW103

Stainless	AISI Class	502	505	410	430	308	308	309	309	310	310	310	310	310	316	317	318	347	347
	A. O. Smith	SW151	SW152	SW153	SW154	SW162	SW362	SW166	SW167	SW159	SW359	SW169	SW168	SW368	SW160	SW161	SW158	SW157	SW357

Complete line of welding accessories

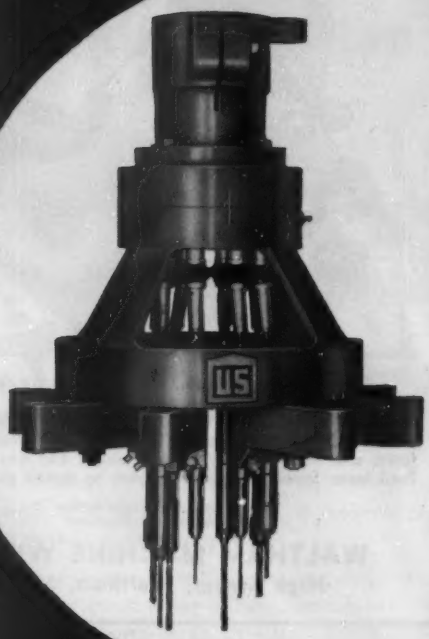
All the essentials to put welding to work are available through A. O. Smith. Quality welding cable, connectors, splicers, ground clamps, tongs, and holders; helmets, shields, gloves, and protective clothing; electrode storage ovens, machines and electrodes ... everything required for welding can be had from one responsible source. Take advantage of this for all your welding needs.



A.O.Smith
CORPORATION
WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

Made by welders . . . for welders

KEEPING UP WITH THE JONESES



U-1

U-2

The "Joneses" and the companies they own save money, time and effort by relying on "US" Adjustable Multiple Spindle Drill Heads with *QUICK-CHANGE* universal joint assemblies.

We give the "Joneses" and you —immediate delivery.

The U-1 Head—two to eight spindles—can be adjusted to a minimum distance between spindles of 11/16" anywhere in an area of a 6" diameter circle.

The U-2 Head has two to twelve spindles, each built to drill up to ¾" diameter hole in cast iron. Standard spindles are furnished with No. 1 or 2 Morse Taper.

Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear driven adjustable, fixed center, or individual lead screw tapping heads.

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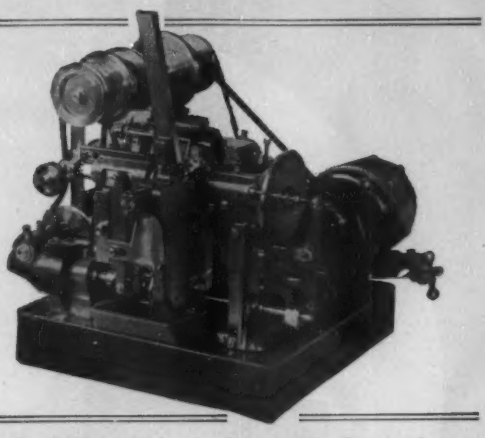

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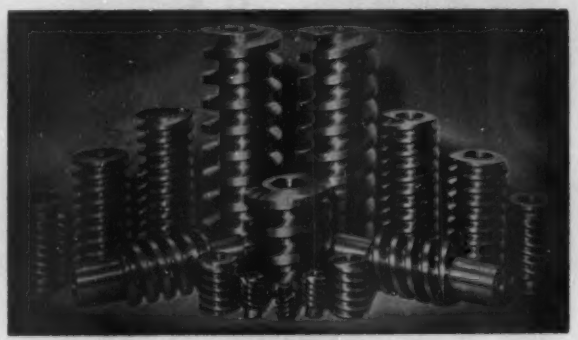

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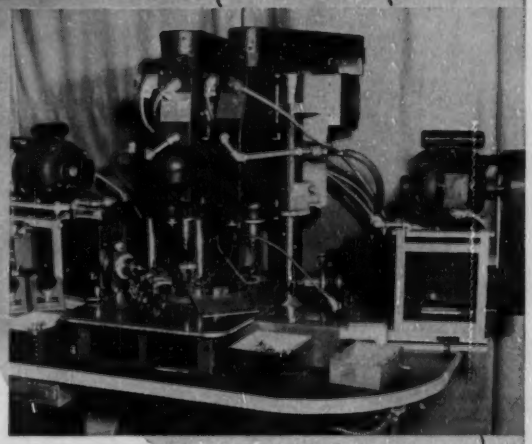
If time meant money he'd drill and tap with

Bellows-LOCKE DRILL UNITS



An extra second or so drilling a hole may not mean much to a woodpecker. But in today's cost picture it means dollars to you.

If you have any part in which you are drilling or tapping two or more holes in any size up to 1/4" or 5/16", The Bellows-Locke Drill Unit offers practical opportunities for substantial cost reduction.

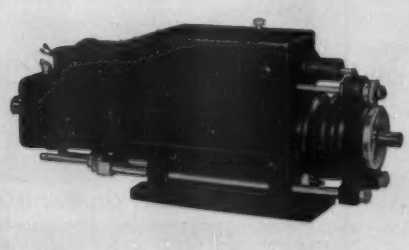
It is particularly effective as a basic component for toolroom-built special purpose drilling and tapping machines. It is compact, streamlined, relatively light in weight, can be installed in any angle in any plane. Any number of units can be easily synchronized and interlocked for accurately timed sequence operation.

The spindle is electrically driven (either pulley drive or direct motor drive). Rapid advance and retract is by pneumatic power. Feed rate is hydraulically controlled. All three circuits: electric, pneumatic and hydraulic are interlocked for simple, positive push-button control.

Major cost reductions are often the accumulated total of many minor savings. Look at your drilling and tapping costs with a critical eye.

WRITE FOR THIS BOOKLET—

Describes the Bellows-Locke Drill Unit in detail — shows how and where it can be used to best advantage. Free on request. Address: The Bellows Co., Dept. AM654, Akron 9, Ohio In Canada: Bellows Pneumatic Devices of Canada, Ltd., 4972 Dundas St., W. Toronto, Ontario, Canada.



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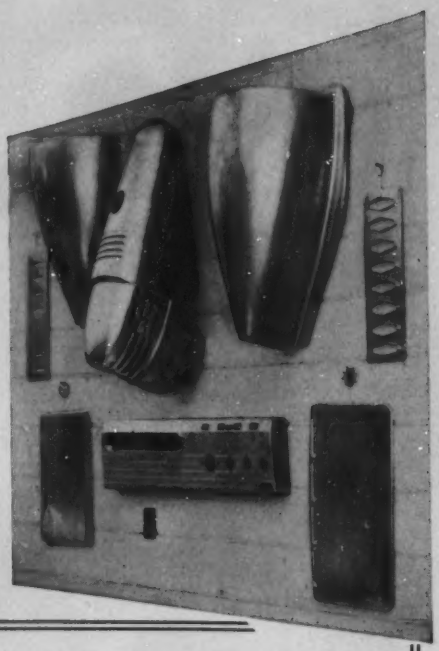

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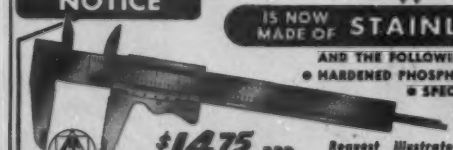

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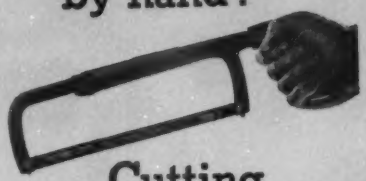
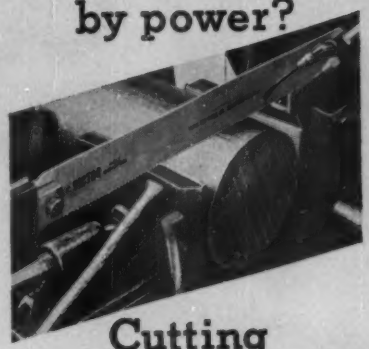


Cutting by power?



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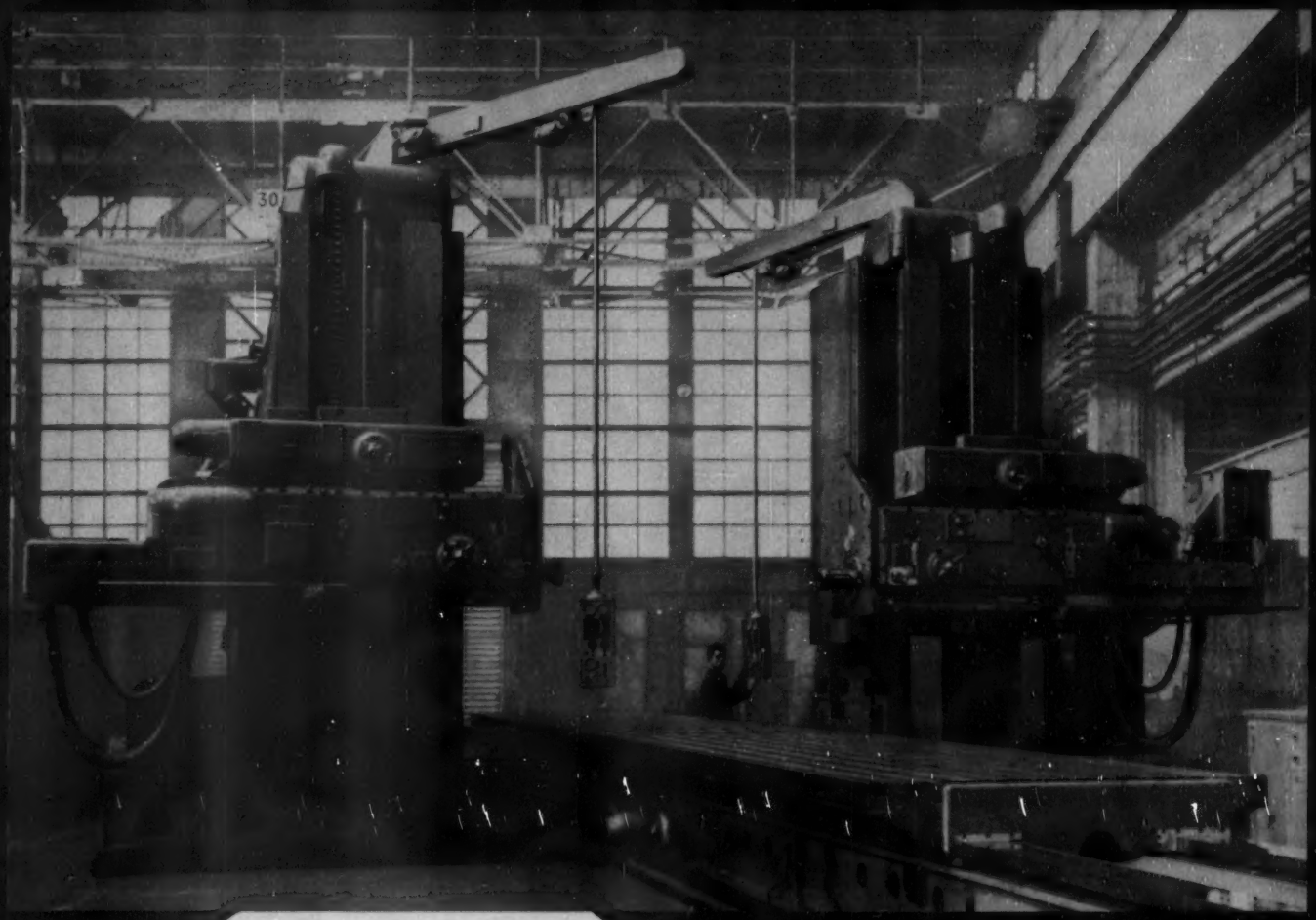

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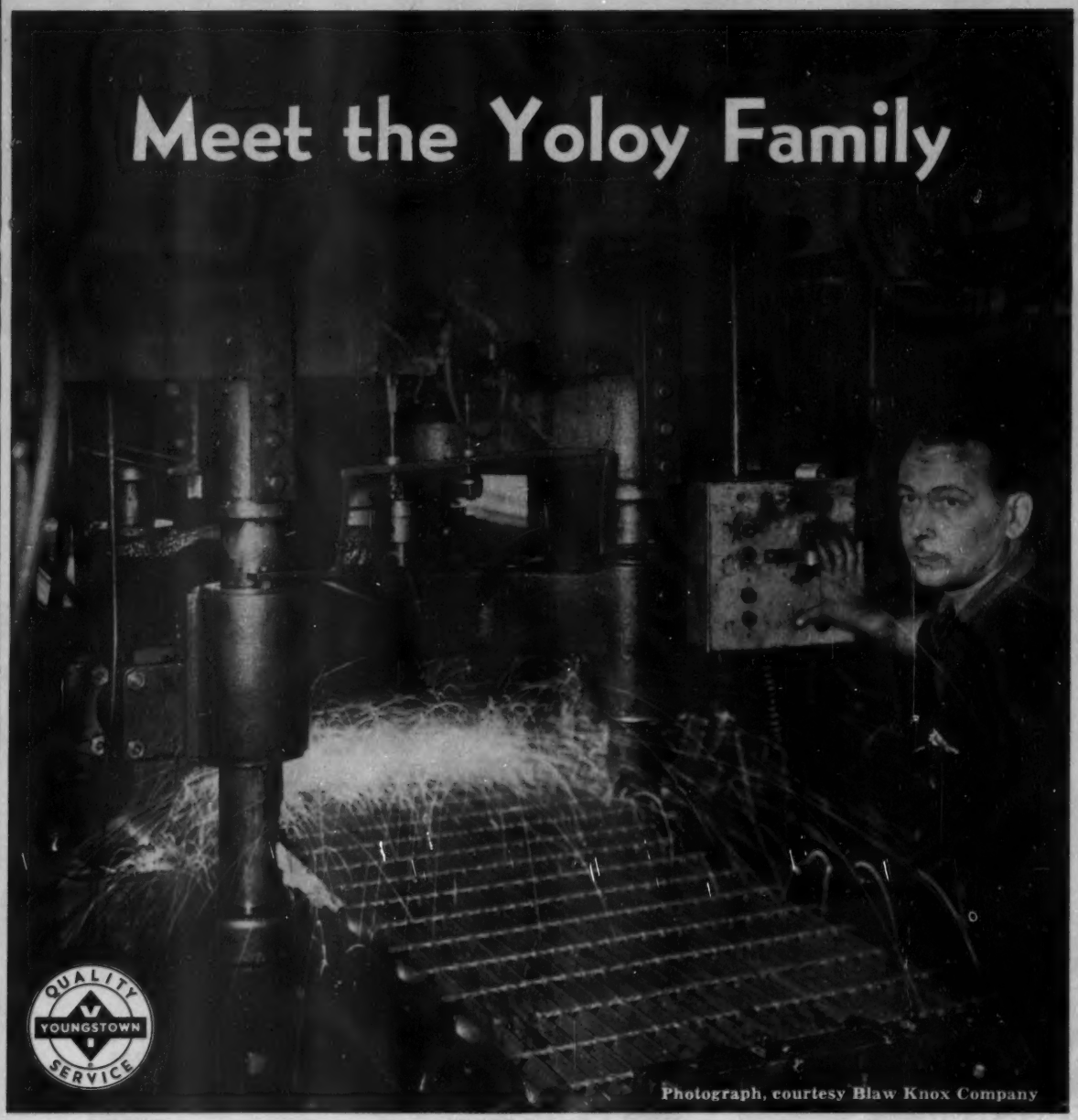
Meet the Yoloy Family



Photograph, courtesy Blaw Knox Company

●The Yoloy Family of steels are available to fabricators and users who require a steel that's high in resistance to corrosion, shock, vibration and is easy to fabricate and weld. The illustration shows fabrication of "Electro-forged"* grating, using Yoloy E steels, where long life and safety require superior properties. Phone or write our nearest District Sales Office for further information.

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Youngstown

YOLOY *(Nickel-Copper)* Low Alloy High Strength Steel
YOLOY E *(Nickel-Chrome-Copper)* Low Alloy High Strength Steel
YOLOY C *(Chrome-Copper)* Corrosion Resistant Steel

THE YOUNGSTOWN SHEET AND TUBE COMPANY Manufacturers of Carbon, Alloy and Yoloy Steel

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a sign of good luck

And to smart gear users
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Finished cuts the first time in boiler plate, plastics, hard fibre, pipe, stainless steel, Transite, etc. 7 models cut variable expansions from 3/8" to 5" holes, with thickness capacities from thin sheets to 1".

SPECIFICATIONS			
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00	1/2" SS	3/8"–1 1/2"	1/8"
0	1/2" SS	3/4"–1 1/2"	1/4"
1	1/2" SS	1"–2 1/2"	1/4"
2	2 MT	1 1/2"–3"	1/2"
3	3 MT	2"–3 1/2"	3/4"
4	4 MT	2 1/2"–4"	3/4"
5	4 MT	3"–5"	1"

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WILSON Makes a Complete Line

There are two types of WILSON *"Rockwell"* Hardness Testers... Regular and Superficial. They come in many styles with accessories for testing flats, rods, rounds, and odd shapes. For micro-indentation hardness testing, there is the WILSON TUKON.

Write for information and let us make recommendations

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AMERICAN CHAIN & CABLE

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WILSON "ROCKWELL" and TUKON Hardness Testers

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REPORT
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Backlash Eliminator

Means More Work in Less Time

An important feature of the *1218 Hydrabrasive Surface Grinder* is its crossfeed backlash eliminator. Instead of having to "back off" the crossfeed adjustment and "come up" to the proper setting each time, the backlash eliminator permits fast precision tranverse adjustments in either direction. You can be sure a movement of .0001" on the crossfeed handwheel equals a .0001" movement of the saddle.

This is another reason why the 1218 Hydrabrasive turns out so much work so accurately, and so easily. For detailed catalog on this fine, modern surface grinder, write Abrasive Machine Tool Company, 8 Dunellen Rd., East Providence 14, R. I.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality is Reflected in the Finish of Your Product

Automatically Separate Stacked Steel Sheets!

ERIEZ

Save Man-Hours...Increase Production

POWERFUL IMPROVED DESIGN

with ERIEZ

NEW SHEET FANNER MAGNET

Your efficiency expert will applaud the Eriez Sheet Fanner Magnet! It automatically separates and "floats" sheets, so operator can pick up individual sheets quickly and safely. Naturally, saves prying and fumbling. Speeds production. Prevents accidents to hands. Prevents double-feed accidents to machinery.

Powered with powerful, fully enclosed permanent magnets. No electric current. No maintenance. First cost is the last.

A free 30-day trial will prove it to you. Write for further information today. Ask for demonstration.

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How To Mark Name Plates In 1/5 the Time

Cutting costs in these times is a good trick if you can do it. You can, on plates requiring detail marking, by using an Automark Electric Metal-Marking Typewriter. The operator lightly touches the key and the Automark does the rest, quickly and automatically. No dial to turn—no lever to pull. Marking output is increased five times and worker fatigue is greatly reduced. Write today for Bulletin 8-16.

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Electric Metal-Marking
TYPEWRITER
Manufactured Exclusively By

AGENTS
Desirable territories open for responsible representatives. Write giving complete information, lines carried and territory covered.

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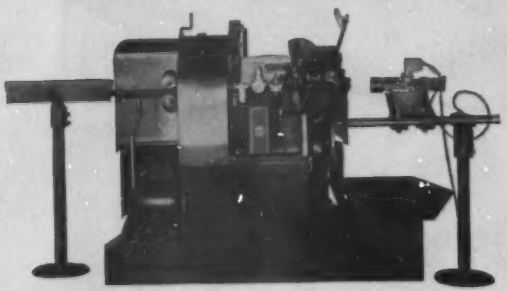
MODERN CUTTING-OFF MACHINE



Cuts off longer pieces than regular automatic machine—*any length you want.* FAST cutting and chamfering of tubing, pipe, shafting. Check the following figures:

½" Tubing
Cuts and Chamfers both outside edges of ½" .030 wall tubing, 5" lengths, every 2.5 seconds.

1¼" Cold Rolled
Cuts and Chamfers both ends, 20" long, at rate of 1 every 20 seconds.

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Cuts and Chamfers both outside edges, pieces 3" long. One every 3 seconds.

4" THREADED STUDS

Modern Automatic Cutting-Off Machines available in 4 sizes, handling work up to 6¾" O.D.

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Cut and chamfered at one time—in 8 sec.—from 10 ft. length of stock already threaded (⅝" U. S. Standard). Clean cut. Clean chamfer. Nuts start easily, with no extra finishing required.

MODERN MACHINE TOOL CO.
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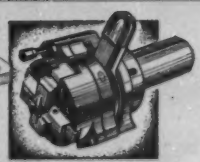
H&C Insert Chaser DIE HEADS



famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

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Pacific Coast Representative: *A. C. Behringer, 834 N. San Pedro St., Los Angeles, Calif.* Canada: *F. F. Barber Machinery Co., Toronto, Can.*

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Stops Losses making Dies and Templates

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END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

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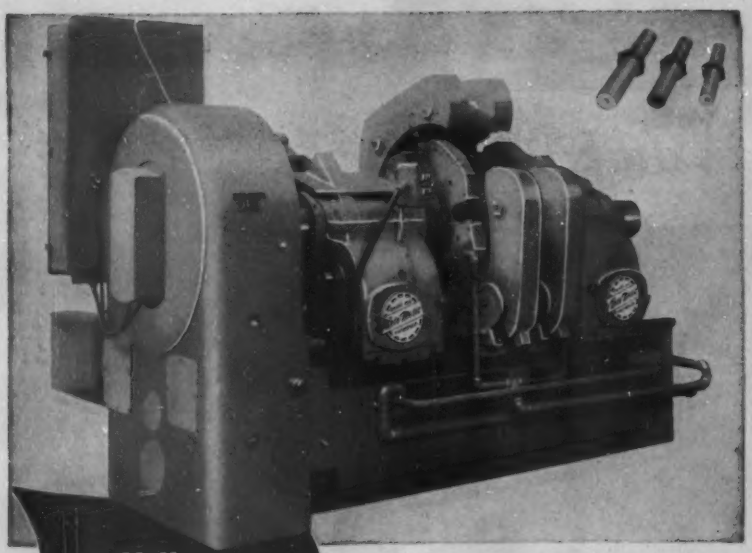

Milling and Centering Simultaneously and in Continuous Production

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FREE DATA on this and other Davis and Thompson machines is available in our bulletin No. 1000.

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Davis and Thompson Co.

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Supplied in one Superior Accuracy
5 MILLIONTHS ± ACCURACY

34 BLOCK SET (shown)..$125 INCL. OPT. PARALLEL

82 BLOCK SET.....$275 IN CASE

These sets will supply the needs of any discriminating shop that must work to gage-block precision. IMMEDIATE DELIVERY

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For Individual Mechanic
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OPTICAL PARALLEL
$5.00 Extra

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Atlantic

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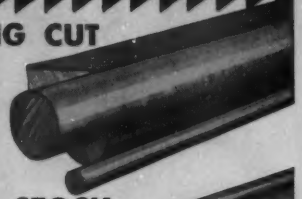
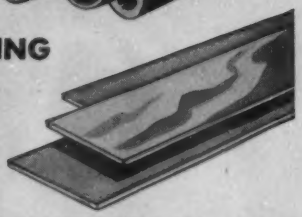
GANG CUT



BAR STOCK

TUBING



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TO THE DESIRED LENGTHS . . .
ON THE SAME MACHINE . . .
IN LESS TIME!

On the toughest metal cutting jobs, Atlantic Wavy Set Bands always deliver faster, more accurate "gravity fed" machine cutting — bite through hardened steel in seconds flat — leave score-free, finished surfaces. Here's the secret behind this vastly superior performance: Atlantic special design band with a wave of teeth to the left, then to the right, sweeps away chips as it cuts — provides cool, free operation throughout prolonged blade life.

FREE!

Send today for the graphic story of Atlantic's family of fine saws. If you have a specific saw application you are wondering about, include a brief description — it will meet interested engineering attention and be promptly acknowledged.

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Savings from $10 to $30 per ton on COILED STRIP

usually pay for the installation of a Yoder Slitter in a year, more or less, where monthly requirements in slit strands are upwards of 100 tons.

Of even greater importance to metal fabricators doing their own slitting, is the fact that they can buy standard width coils competitively, wherever they can obtain the best price and delivery, while otherwise they are often limited to the few sources able to supply slit-to-width strands.

Changes in production schedules can also be more readily made, and strip inventories greatly reduced because expected and unexpected needs can be met on a few hours' notice from a relatively small stock of standard width coils.

The economics as well as the mechanics of Slitter operation are fully discussed in the Yoder Slitter Book . . . yours for the asking.

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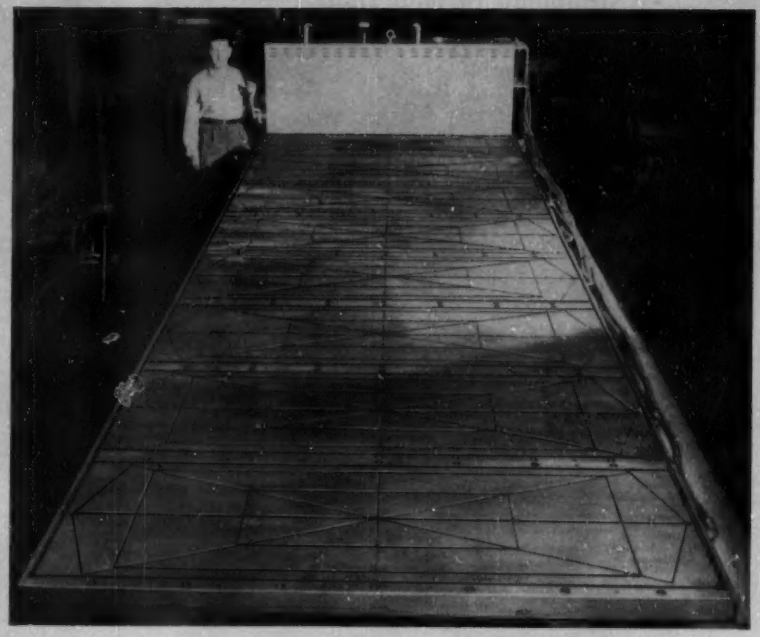

Walker pioneer in the chuck industry, has been utilizing magnetic force to make all types of special and standard chucks since 1887.

Walker now harnesses atmospheric force for special vacuum chucks to hold non-magnetic materials. First a leader in magnetic force—now a pioneer in atmospheric force.

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WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

The LINLEY JIG BORER

Put your small jig boring jobs on this precision machine

Here's a machine, available at extremely low cost, that will enable you to save your larger machines for larger, heavier work. You'll find it meets your most exacting requirements for precision. Get our accuracy information and you'll see what an outstanding investment this machine represents

Table movement: 6" x 10"; table size, 7" x 17½".

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For Ease, Economy and Simplicity of Operation

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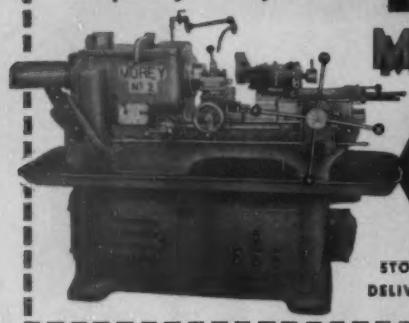

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Designed to take full advantage of tungsten carbide tools, the modern MOREY Turret Lathes are ruggedly and heavily built for continuous duty, maintaining close tolerances. New methods of speed and feed control are incorporated, permitting even the inexperienced operator to select almost instantaneously the speed and feed best suited to the work... ideal for both bar and chucking operations.

Sales territories open

PARTIAL LISTING OF SPECIFICATIONS:

Bar work capacity	1" dia. x 6"
Chucking capacity	8" dia.
Swing over bed	14"
Hole through spindle	1-9/32"
Spindle speeds (Back gear ratio: 60-2000 RPM inf. variations with constant speed, AC 1800 RPM motor 1:5.8	
Motor	3 HP

For complete details write to Department A-6.

MOREY *for machine tools!*

MOREY MACHINERY CO., INC.
Manufacturers • Merchants • Distributors
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ALGONQUIN 4-8500 • CABLE ADDRESS: WOODWORK, N.Y.

World's Hardest Metal

Many times more durable than steel, Talide Metal adds years of life to the wearing edges of tools, dies, machinery and equipment.
Hard as a diamond and almost indestructible, it triples output per man and per machine.
For good service and recommendations for improving any cutting, drawing or wear-resistant application, send particulars to Metal Carbides Corp., Youngstown 7, Ohio. *Write for Catalog No. 54-G*

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This low cost machine will handle internal keyseating jobs up to 1 in.

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DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

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Stainless Steel TAPER PINS

Complete stock, all sizes #7/0 through #14.
Special sizes to order.
Milled or Centerless Ground (Precision Type).
Made to accurate tolerances.

Also "Stanho" Taper Pins made from selected screw stock, Monel, Brass, Aluminum or other metals. Clean bright finish —prompt shipments.

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JM-6

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HARDNESS TESTER

The *Scleroscope* is the only hardness tester that takes in the entire range from the softest to the hardest metals without any adjustments.

MODEL D-1 DIAL TYPE

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"it may never happen"

True—and let's hope it never does. But the moment when we're least expecting it would be the best moment for an aggressor to attack. And the atom bomb isn't the only emergency that may hit us. Fires, floods, explosions, tornadoes also strike with little or no warning. Be ready for disaster, whatever form it takes. Do these simple things TODAY:

- ☐ **Enlist the help of your local Civil Defense Director.**
- ☐ **Check contents and locations of first-aid kits.**
- ☐ **Send staff to Red Cross courses. They may save your life.**
- ☐ **Promote preparedness in your community. Your local CD Director can show you how.**

Set the standard of preparedness in your plant city—check off these four simple points NOW.

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Our client—a large, long established manufacturer of high precision machinery—wants a new and distinctive product line. We shall be interested in:

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The machine, accessory or attachment must be developed to the point of commercial use. Our client is prepared to supply working capital and production facilities needed for rapid development of the business.

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6/21/54

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Old established cutting tool manufacturer desires experienced representatives in Chicago and Pittsburgh to sell milling cutters and special cutting tools on commission basis. Established agents having kindred but non-competing lines preferred.

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Machine Shop Screw products, sales over $100,000 year; fully equipped; good accounts; plenty sub-contract work; owner must sell; priced right. Apple Co., Brokers, Cleveland, O.

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1 Michigan Shear Speed Gear Shaper, Model #1873

1 American Wheelabrator equipped with 48" diameter work table

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1 36" Bullard Cut Master Vertical Turret Lathe

1 Reishauer Gear Grinder, Type ZA

1 Fellows 20M Red Liner Measuring Instrument

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Advise age, serial numbers, condition and full particulars

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Bullard Mult-Au-Matic 12" with 8 Stations for Double Indexing. Should Be Built 1945 or Later. Give Serial #, Age, Condition and Price.

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24"x10' AXELSON GEARED HEAD, HEAVY DUTY MODEL "E" 28" ACTUAL SWING, M.D. TAPER ATTACHMENT.

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20"/27¾"x14' AXELSON Lathe, 115" centers, Taper Attachment, Late.

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24", 36" BULLARD Vertical Turret Lathe, New Era, Turret Head, Side Head, Motor Driven.

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No. 1 LaPOINTE Motor Driven Horizontal Broach, 5 tons cap., 38" stroke.

50 HP. CHICAGO PNEUMATIC Air Compressor. Type NSB, 253 CFM, Piston Displacement.

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#2 KEMPSMITH Horiz. Maxi-Mill, Motor in base, Vert. Head.

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No. 3B KEARNEY & TRECKER Horiz. Mill, Double Overarm, Motor in base.

No. 2M CINCINNATI Universal Horizontal Mill, Full Equipment, M.D.

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4'x15" Column CINCINNATI-BICKFORD "Super-Service" Radial Drill, Motor on arm, Box table.

4' x 15" CARLTON Radial Drill, Motor on arm, 48 spindle speeds, 1943, Late Type.

No. 262 BARNES Motor Driven Sliding Head Drill Press. 2" cap. in steel.

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#5 M.T., Coolant System. Late Type. 26" Swing, 1942.

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600 ton NILES-BEMENT-POND Motor Driven Wheel Press, 86" between strain rods, 14' cap., 17" diam. ram.

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10"x10" RACINE #30-C Hydraulic Heavy Duty Shear Cut Power Hack Saw, 1946.

10'x10 ga., 10'x¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

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6"x18" LANDIS Type "C" M.D. Hydraulic Cylindrical Grinder, Serial #29196.

6"x18" NORTON Vertical Hydraulic Surface Grinder, complete with magnetic chucks, coolant systems, Late Model.

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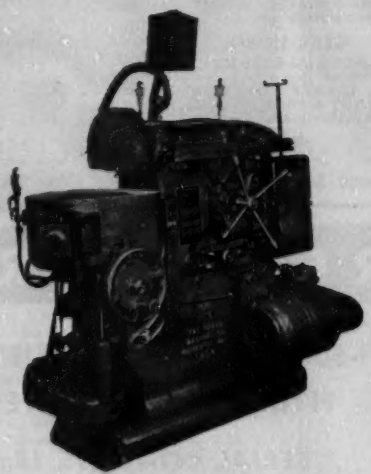
No. 208 BESLEY Motor Driven Disc Grinder, 26" wheels, Late Type.



No. 22 HEALD MOTOR DRIVEN ROTARY SURFACE GRINDER. 12" Magnetic Chuck. Late Model.

20", 24", 28" GOULD & EBERHARDT V-Ram Shapers, M.D.

No. 194 BARNES Vertical Hone, 4" capacity, 12" stroke, Motor Driven.

30 K.W. LEPEL High Frequency Induction Heater.

No. 8LS FELLOWS M.D. Gear Lapping Machine. With Detachable Head, Universal Work Support.

No. 20, WATERBURY FARREL Thread Roller, ⅛" cap., 1944.

#0, 1½ BUFFALO FORGE Universal Ironworker, Notcher, M.D.

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1941-1954 MACHINE TOOLS

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FELLOWS: Flat Top Helical Gear Cutter Grinder
OLIVER: 10" Template Tool Bit

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ALLEN: #2 High Speed 16"
BARNES: No. 210, 2-spindle, 21" Swing
PRATT & WHITNEY: ½B x 80 Deep Hole Drilling & Reaming Machine, 2-spindle
RADIAL DRILLS: Archdale, 5', 6' & 7', new

GEAR MACHINERY
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FELLOWS: Flat Top Helical Gear Cutter Grinder
FELLOWS: Straight Line Generator, 3" dia. with many cutters
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SYKES: Rack Cutting Machine 12" to 36" length capacity (New)
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GEAR GRIND MACH: GG-19, 10"x24" Hydr. Spur Gears and Splines
INTERNAL GEAR GRINDER, GG-31

GEAR TESTERS
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FELLOWS: #12C Cone & Spacing Inspection Instrument
GLEASON: No. 3 Bevel Gear Tester
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CLEVELAND: #130 & 140 Rigidhobbers
REINECKER 60"
BROWN & SHARPE No. 44 20" cap.
SCHUCHARDT & SCHUTTE, 36" cap.
LEES-BRADNER 42A

GRINDERS—CYLINDRICAL
BROWN & SHARPE: No. 10 cap. 6"x18" plain
CINCINNATI, 6"x18" Hydraulic, Plain
LANDIS: 16x32" Type "D" Crankpin, hydraulic, for grinding crankshafts
NORTON: 12"x18" Type C, Universal
NORTON: 10"x36", 30 Deg. Angle Wheel
NORTON: 10"x18" 45° angle wheel

GRINDERS—GEAR & SPLINE
GEAR GRIND MACH.: GG-19, 10"x24" Hydr. Spur Gears and Splines
GLEASON: #17, 23½" P.D.
PRATT & WHITNEY: 10" single and double wheel, hydraulic feed
INTERNAL GEAR GRINDER, GG-31

GRINDERS—INTERNAL
HEALD: #50 Planetary
HEALD: Model 72A3 sinematic & 72A5

GRINDERS—RADIUS
VAN NORMAN: #7S, capacity 7½"
VAN NORMAN: #648-16, cap. 6" to 16" dia.
VAN NORMAN: #3½ Un. Radius

GRINDERS—THREAD
EXCELLO: #61 External, dia. 5"x18"

HONING MACHINES
BARNES: Model 224, 4" dia. x 16" stroke
BARNES: Model 172, 7" stroke.
MICROMATIC: H-510 Double End Horizontal, ¾" to 2" dia.
MICROMATIC: H-2 Single End Horizontal, 2 spindle, ¼" to 1" dia.

LAPPING MACHINES
FELLOWS: 8 LSI and 13 LSI Gear Lappers, external and internal spur and helical

LATHES—PRODUCTION
BLOUNT: Polishing speed lathe 12" dia. x 48" centers
LODGE & SHIPLEY: #3A Ducmatic, 25½" swing x 27" centers
POTTER & JOHNSTON: #4D Auto Turret

LATHES—TURRET
BULLARD: 36" Vertical turret
WARNER & SWASEY: #1A, #2A, #3, #3A, #4, #4A & #5

LATHES—TURRET—continued
HERBERT: #0, #2, #4, #7, #8 and #9B/30 Sizes, new
WEBSTER & BENNETT: Vert. 36" & 48" (New)

MILLING MACHINES
TAYLOR-FENN: M-30 Duplex Spline
RICE-BARTON: 4" Twin Spline
VAN NORMAN: 10CT Contour Miller, horizontal opposed spindle type for milling flat cams, also can be converted to similar work

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RUSSELL: 9½" cut-off Saw with Auto. Stock Feed (New) Hydraulic
RUSSELL: 5½" dia. cut-off saws, auto stock feed, hydraulic (New)
MOTCH & MERRYWEATHER: No. 3 Circular Saw with auto. stock feed
MARVEL: No. 6 Hacksaw, 6"x6"

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LANDIS: 2½" single head horiz. threading machine
LEES-BRADNER: #40A Thread Miller
LEES-BRADNER: CT-36 Thread Miller chucking type, 13¾" hole
MURCHEY: #12 Horizontal threading and tapping machine, ⅛" to ½" dia. capacity, single spindle

MISCELLANEOUS
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AUTOMATIC SCREW MACHINE, Wickman, Single Spindle, 7/16" New
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3 spindle Rockford Gang Drill, m.d.
3 spindle 28" Cincinnati-Bickford Upright Drill, m.d., No. 4 Morse Taper
4 spindle Niles-Bement-Pond, m.d., 12' rail, No. 5 Taper
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No. 7, 7A Fellows, belted m.d.
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No. 6I Fellows, gear box, m.d.
No. 6IA Fellows, m.d., latest type
No. 64S Fellows, m.d.
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10" Pratt & Whitney Hydraulic Spur & Helical
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SG11 Gear Grinding Machine, m.d., latest
GG19 Gear Grinding Machine, m.d., latest
GG31 Gear Grinding Machine, Internal Gear & Spline Grinder, m.d.

GEAR HOBBING MACHINES

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Type A Barber-Colman, m.d.
No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 12 Barber-Colman Double Overarm, m.d.
No. 12 Barber-Colman Single Overarm, m.d.
No. 34 Brown & Sharpe, m.d.
No. 44 Brown & Sharpe, m.d., Spur & Spiral
No. 3 Newark Gear Hobber, Plain Type, m.d.

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18" Gleason Bevel Gear Tester, m.d.
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Hammond Disc Grinder, Model No. 600
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7½ H.P. U. S. Elec. Tool Co. Disc Grinder, m.d., new
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No. 24—53" Gardner Horizontal, m.d.

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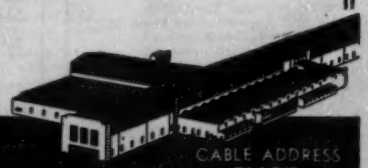

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AUTOMATICS
1-1/16" Cleveland Model A (1942).

BORING MACHINES
No. DB2112 Excello Single End Borer.
100" Niles-B-Pond Vert. Bor. Mill.

DRILLS
No. 2 Avey Cam Fd. Drill. 14" Swing.
2 Spdl.—24" SW.—No. 3 Avey.
No. 57TH Fox 24 Spindle Multiple Drill (1943)
No. K60H Fox Multi Spdl. Drill.

GEAR MACHINES
11" Gleason Gear Generator.
No. 12HS Gould & Eberhardt.
No. 36-BM G. & E.—3 spdl. Rougher.
615-A Fellows Gear Shaper.
612-A Fellows Gear Shaper.
No. 64 Fellows Gear Shaper.

GRINDERS
5"x30" Cam-o-matic (1946).
6"x18" Norton Type C Plain (1943).
10"x36" Norton Type C Grinder.
10"x36" Norton Type C Cam Grinder.
10"x48" Norton Type C Pl. (1943).
No. 4 Cinn. Hi-Speed Type C Pl. (1944) Dial
TG 615 J & L Thrd Gdr.
B24-25" Chuck Arter Surf.
No. 1109 Bryant Internal Gdr. (1951).
No. 5 Bryant Internal Grinder.
No. 5B Bryant Internal Grdr.
No. 16-16 Bryant Int. Grinder.
No. 16-28 Bryant Int. Grinder.
No. 1c A-28 Bryant Internal Grinder.
No. 16-36 Bryant Int. Gdr.
No. 24-26 Bryant Int. Grinder.
No. 24-36 Bryant Internal Grinder.
No. 24L—36 Bryant Hyd. Internal Gdr.
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Model 200-H5-Dbl. End Micro. Horiz.
Model H-7 Micromatic Vert. Hone
No. 224 Barnes Vert. Hone

LATHES
R-14 Lo-Swing Automatic Lathe.
18"x6' Am. Geared Head Lathe.
18"x8' Lodge & Shipley Grd. Hd.
27"x12' American Geared Hd. Lathe.
27"x12' centers LeBlond Lathe.
36"x18' Putnam Grd. Hd. M.D.
No. 2 Warner & Swasey Geared Head Turret.
No. 3 Warner & Swasey Bar Feed Turret.
No. 5W Acme Tur. Lathe (Late).
No. 3AL Gisholt, Cross-Slide Turret.
No. 4A Warner & Swasey Turret.
No. 6 Warner & Swasey, cone head, Turret.
2¼"x24" Jones & Lamson, turret.
18" Libby, M.D., turret.
No. 4A Warner & Swasey (1944).
No. 4A Warner & Swasey, Taper, Cross-sliding Turret (1942).

PLANERS
48"x36"x14' Gray, 2 Heads.
48"x48"x12' Cincinnati, 2 Heads.
60"x48"x27' American, 4 Heads.

MILLING MACHINES
No. 08 Cincinnati Vert. (1942).
4" Taylor & Fenn Duplex Spline.
10"x48" Hanson-Whitney Thrd. Mill.
10"x60" Pratt & Whitney Thrd. Mill.
12"x102" Mod. HT Lees Bradner Thrd. Mill.
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16"x84" centers REED PRENTICE Model AA Toolroom Lathe, new 1944
28"x15' centers BERTRAM (Niles patterns) "Timesaver" Engine Lathe, 2 carriages, rapid traverse, AC-MD, new 1949
36"x12' centers AMERICAN Heavy Duty 18 Speed Geared Head Lathe, AC-MD
80"x20' NILES-BEMENT-POND Geared Head Engine Lathe, rapid traverse
No. 1L GISHOLT Saddle Type Universal Turret Lathe, preselector head, bar feed, chuck, new 1943
No. 2A WARNER & SWASEY Universal Turret Lathe, preselector head, bar feed, chuck, new 1943
No. 3A WARNER & SWASEY Turret Lathe, Timken spindle, electric chuck, tooling
No. 3 WARNER & SWASEY Universal Turret Lathe, 000,000 series
No. 4 GISHOLT Turret Lathe, Timken spindle, hardened ways
No. 2 VAN NORMAN Plain Horizontal Mill. New 1943
No. 3-24 CINCINNATI Plain Hydromatic Mill, AC-MD
No. 4 CINCINNATI High Speed Dial Type Plain Horizontal Mill, new 1942
No. 4 CINCINNATI High Power Dial Type Vertical Mill, 25 HP motor, new 1951
No. 5 CINCINNATI High Power Vertical Mill, new 1951
48"x48"x10' NILES Double Housing Planer, box table, DC reversing motor drive.
48"x48"x12' Cincinnati Double Housing Planer, power rapid traverse, DC reversing motor drive, box table, forced feed lubrication.
48" widened to 60"x12' DETRICK & HARVEY Double Housing Planer, box table, DC reversing motor drive
1¼" LANDIS Belt Threader, leadscrews, AC-MD
30" MORTON Hydraulic Keyseater, new 1943
No. 6A MITTS & MERRILL Keyseater, capacity 0 to 4" width, 36" stroke, tooling
4' HAMMOND Jackknife Radial Drill, tapping attachment, new 1948
5'-13" column CARLTON Radial Drill, AC motor & gearbox on base
6'-17" column CINCINNATI BICKFORD Super Service Radial Drill, power rapid traverse, motor on arm
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3½" bar Defiance, Table (2)
4½" bar Sellers Floor Type
8" Bar Niles, Floor type
RADIAL DRILLS, 5'15" col. Amer., Motor-on-Arm
GRINDER, 10"x96" Landis Hyd., Late
GEAR SHAPERS, Nos. 6425AS, 61A & 61 Fellows
LATHES, 48"x20' & 24' beds Niles (2)
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SLOTTERS, 20"-24" & 12" Dill-Labelle
30" Rockford Hyd. 1942

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Monarch 36" x 41' ctrs. Model NN—Swing over ways 37½" — Camlock spindle — 2 carriages — 2 taper attch.—MD

American 42" x 25' ctrs. Geared Head—16 speeds—MD

American 36" x 13' ctrs. Geared Head—12 speeds, range 9-400 RPM—MD—1943 machine

Monarch Helical Geared with 30½" actual swing x 18' ctrs.—Camlock spindle—16 speeds 11-500 RPM—MD—Late

DRILLS, RADIAL

Carlton 7' 17" col. Motor-On-Arm—48 speeds, 10-1250 RPM—15 HP MD—1941 machine—Duplex base

Fosdick 3' Motor-On-Arm—5 HP MD—Late type

GEAR CUTTERS

Gould & Eberhardt 96" x 30" Automatic Spur & Helical Gear—Auxiliary table—All power feeds—Feed, index and cutter speed gears—MD

Pfauter #5 Automatic Spur, Helical and Worm Gear Generator—Max. cap. 118" x 22" face—End milling attch. for herringbone gears—Feed, lead and index gears

(4) Barber-Colman Type A Gear Hobbers—Power down feed—Single thread indexing—1947 machines

CINCINNATI #5-42 VERTICAL HYDRO BROACHING MACHINE—Late type

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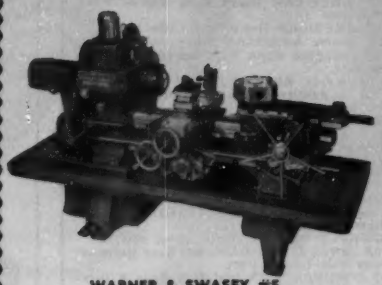

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ACME GRIDLEY R6 1⅝", 6-spindle; late type
ACME GRIDLEY R8, 1⅝", 8-spindle; late type
CONOMATIC 1⅞", 6-spindle; M.D., late type
CLEVELAND 3¼", Model "A" Single spindle
CLEVELAND 8", Model "A", single spindle; late
NEW BRITAIN GRIDLEY Model 865; 6-spindle chucker; latest type; new 1943.

BORING MILLS—Horizontal

NILES 8" bar; floor type; motor drive
LANDIS No. 35 Floor Type Horiz. Boring Mill; late
LUCAS No. 31 3" bar, motor drive, late type

BORING MILLS—Vertical

BULLARD 24", spiral drive, M.D., late type
BULLARD 54" Spiral drive, motor drive, late
CINCINNATI 96", 2 swivel hds., PRT; M.D.
NILES 53", 2 swivel heads, PRT; MD.
NILES 100" 2 swivel heads, PRT; M.D.
SELLERS 144", 2 swivel heads on cross rail; PRT; M.D.

BROACHES

CINCINNATI 1-30 Duplex Vertical cap. 2,000 lbs. 30" stroke; Hydraulic; late.
COLONIAL V6I-10-48 Vertical; Hydraulic; late
LAPOINTE 10-54" Vertical, Model SRV; new 1947
OILGEAR type XL-6 single ram; late type.

DRILLS

AMERICAN 4' arm 11" col. "Hole Wizard", late
AMERICAN 5' arm 11" col. "Hole Wizard", late
AMERICAN 5' arm 13" col. "Hole Wizard", late
NATCO B3B Hole Steel, 12 adj. spindles; late type
NATCO Model B4B arranged for 45 spindles, late
NATCO Model E5 arranged for 12 spindles; late

GEAR EQUIPMENT

FELLOWS #6, 6IA, 75 H.S. Gear Shaper; late
GLEASON 12" Straight Bevel Gear Generator
GLEASON 3' Spiral Gear Generator; late type
GLEASON #17 Spiral Bevel Hypoid Gear Grinder
GLEASON #24 Straight Bevel Gear Generator; late
BARBER COLMAN Type "A" Gear Hobber; late
GOULD & EBERHARDT #12-H Gear Hobber; late
GOULD & EBERHARDT #120-H Double head Universal; late type

GRINDERS, Cyl. Plain

CINCINNATI 6"x18" Plain, "Filmatic"; late type
CINCINNATI 10"x48" Plain "Filmatic"; late type
LANDIS 10"x18" type CC Plain, Hydraulic, late
LANDIS 14"x72" Plain type "C" Plunge; late type
NORTON 4"x12" Model CTU Plain, year 1953
NORTON 6"x18" Type "C" Plain; late type

GRINDERS, Internal

BRYANT #5, #16-C-16 Hydraulic; late type
BRYANT #24-36" Hydraulic; late type
HEALD #70A Int. M.D., late type
HEALD #81 Plain chuck type; New 1947
HEALD #72AS Plain & "Gagematic"; late type

GRINDERS, Surface

ABRASIVE #34, 6"x24" table; late type
HEALD #22 Rotary, 12" chuck; M.D., late.

LATHES, Turret

BARDONS & OLIVER #5 Univ. Ram Type; late
GISHOLT #1L and #2L Saddle type; Timken; late
GISHOLT #3 Universal ram type; M.D., late
MOREY #2, #3, #4 ram type; Timken; latest type
WARNER & SWASEY #3 and #5 Univ. ram type; M.D.

LATHES, Engine & Mfg.

HENDEY 24"x36" centers; M.D., late type
LeBLOND 20"x48" centers; Timken; late type
LODGE & SHIPLEY 14"x30" centers; late type
MONARCH 12"x30" centers; Model CKK; late type
NILES 30"x50' bed, single end boring, "Time Saver"; late type
PRATT & WHITNEY 10"x30" centers; Timken
REED PRENTICE 14"x54" centers; Timken; late
SUNDSTRAND 60" centers; auto Type B; late

PLANERS

DETRICK & HARVEY 48"x48"x16'; 4 hds; hydr.
GRAY 36"x36"x10' "Maximum Service" 4 hds; PRT; DC; Reversing
GRAY 48"x48"x10' "Maximum Service" 4 hds; PRT; DC; Reversing
LIBERTY 144"x76"x48' adj. openside; box table; 4 hds; vari-voltage; PRT; New 1940
NILES-BEMENT-POND 72"x72"x30'; 4 hds; PRT; DC; MD

PRESSES

BLISS #410A, 525-ton double action toggle drawing press, with or without cushions; M.D.
NATIONAL #3 "Maxi-Press", 1000-ton cap. H.S. Forging Machine; M.D.
SHAW 250-ton Hydraulic flanging press; late
WATERBURY FARREL #9, 125-ton cap., M.D.

SHAPERS and SLOTTERS

DILL 18" Slotter; motor drive
GOULD & EBERHARDT 32" H.S. Shaper; M.D.
PRATT & WHITNEY 6" & 10" Vertical; M.D.
ROCKFORD 36" Vert. Hydraulic Slotter; late

MILLING MACHINES, Plain

KEARNEY & TRECKER Model 2HL; M.D., late
KEARNEY & TRECKER 4H Plain, Timken; late

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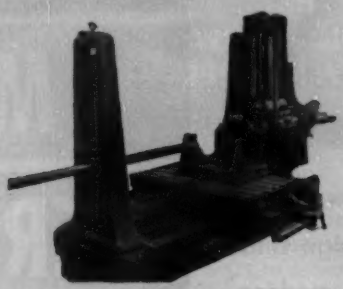

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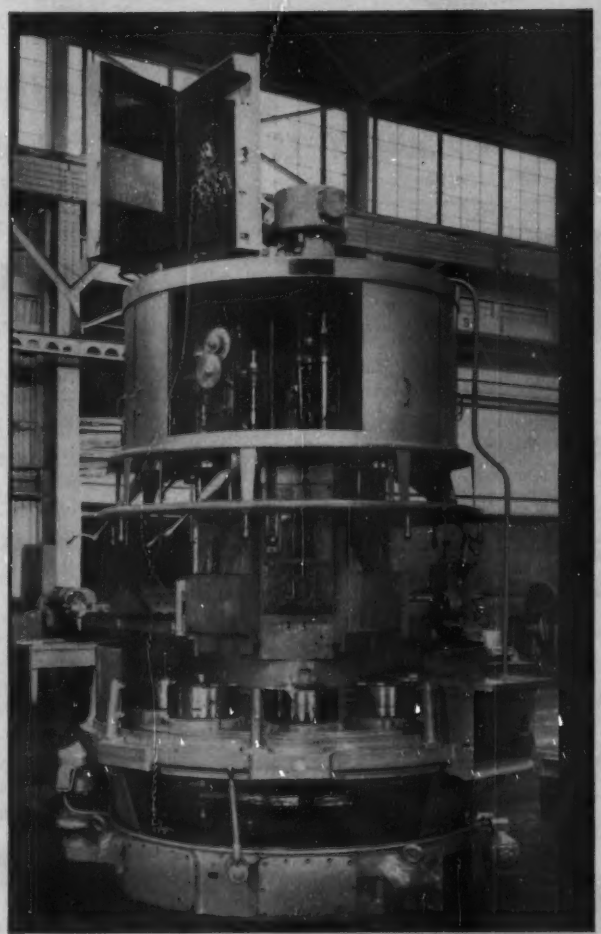

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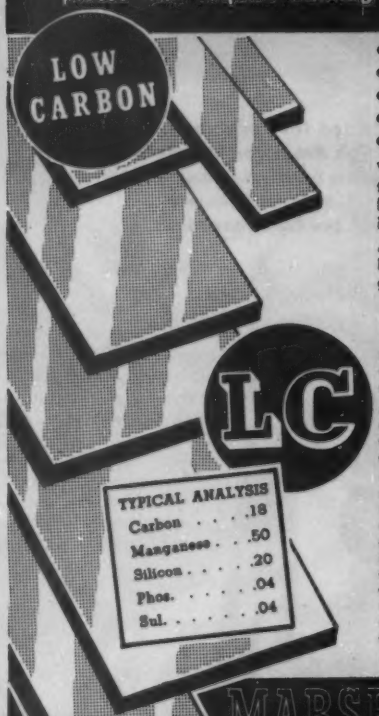

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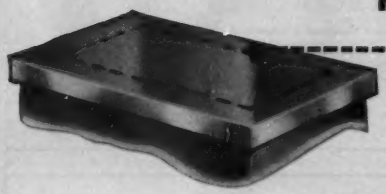

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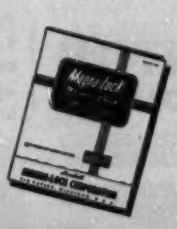

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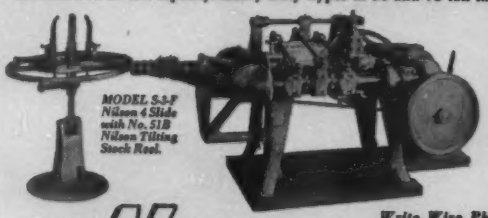

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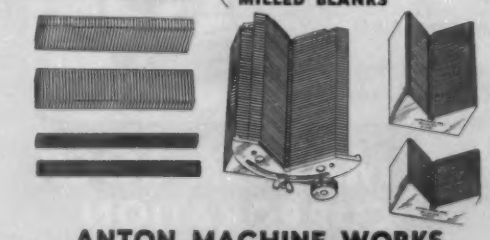

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Small Hole Gauge

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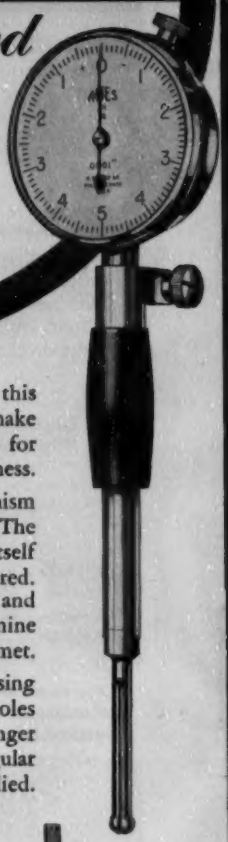

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New Harvey deep-drawn aluminum machining stock will cut your costs

This new deep-drawn aluminum machining stock developed by Harvey has acquired peak production characteristics for the metal machining industry by means of the unique method by which it is "worked". Deep-drawing under extremely high pressure creates a completely new metallurgical structure. The resulting macrostructure change of the metal, giving high, consistent uniformity from the outside to core, is to a large degree responsible for the fine machinability of the new material. It allows fast cutting with highly desirable small chips, yet extends tool life, and gives true threading.

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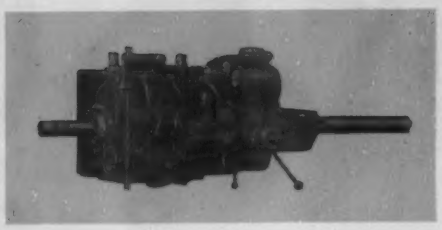
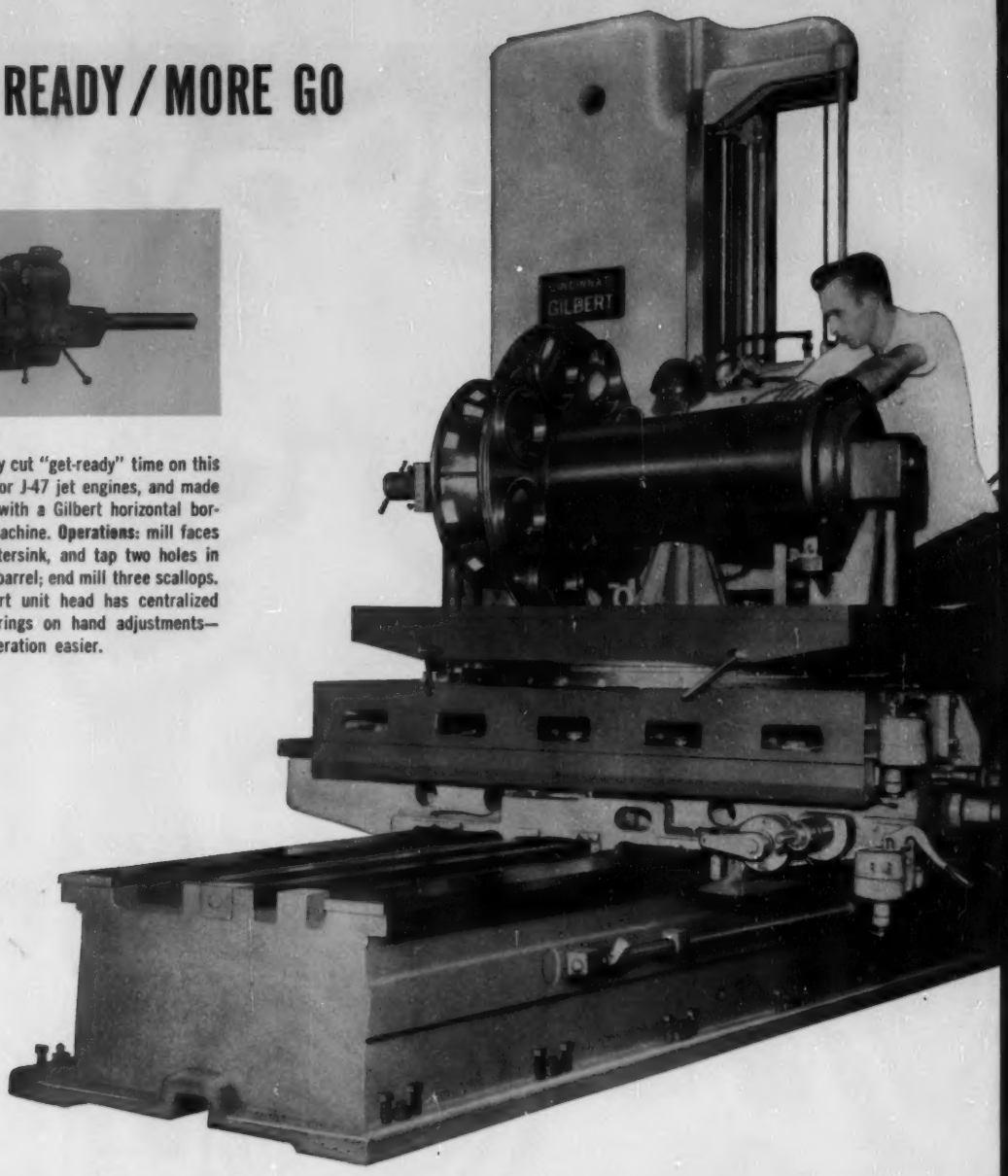
LESS GET-READY/MORE GO



Ryan Aeronautical Company cut "get-ready" time on this stainless steel aft frame for J-47 jet engines, and made "go" time produce more with a Gilbert horizontal boring, drilling, and milling machine. **Operations:** mill faces of lifting pad; drill, countersink, and tap two holes in pad; drill hole in aft frame barrel; end mill three scallops. **Time:** 105 minutes. Gilbert unit head has centralized controls, anti-friction bearings on hand adjustments—makes indexing faster, operation easier.



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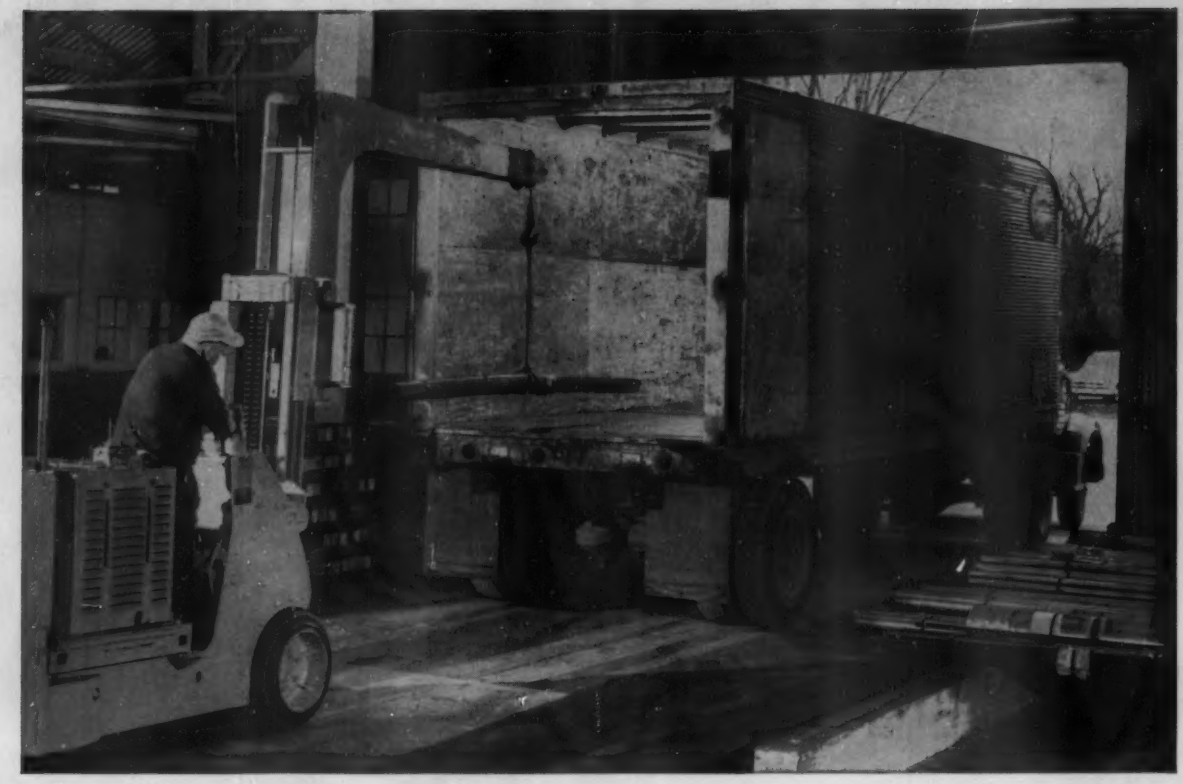

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